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## INTERNAL DERANGEMENTS OF THE KNEE[1]


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I HAVE chosen the subject of derangement of the knee-joint because comparatively so little has been written about it in your own country, and this has always been a matter of great surprise to me, for your games, like our own, are rough, and we in England know to our cost that your youth are very skilled and very strenuous. I am credibly informed that the anatomy of their knee-joints differs but little from our own, and I am forced to conclude either that their cartilages are more securely placed than ours, or, which is most unlikely, that the condition is not so generally recognized as it should be. When I mention to you that I have explored the knee-joint in search of mechanical derangement on considerably over one thousand occasions and that surgeons all over England are adding their large experiences to our literature, it seems perhaps appropriate that I should endeavor to place before you some practical points which may be helpful both in making clear the diagnosis and in simplifying the treatment.

By far the most common derangement of the knee is injury to the internal semilunar cartilage. In my experience this occurs eight times as often as does injury to the external meniscus. The internal cartilage is more firmly fixed and is not allowed the give-and-take movement vouchsafed the external, and in addition it bears a greater strain during the normal movements of the joint, often becoming thinned and frayed along its inner margin. In the normal relation of femur to tibia the line of force is carried through the inner side of the knee, while the abducted position of the foot when exaggerated produces outward rotation of the leg. A further reason for the disproportion may be the shape of the internal articular surface of the tibia which allows the internal condyle of the femur to glide backwards on the tibia; thus the range of internal rotation of the femur on the tibia, which is a direct strain on the semilunar, is greater than that of external rotation. In view of the fact that displacement of the internal semilunar will at times give rise to symptoms on the outer side of the joint it is well to remember how rarely the external cartilage is displaced.

We must also remember that in nearly all cases the cartilage is displaced inwards, and in those rare cases where a protrusion has been felt from the outside, it is due to hæmorrhage following a tear, a localized bruising of tissue, or a buckling of cartilage accompanied by effusion, which gives rise to an irregular outline of the articular margin. When we consider the shape of the discs an outward displacement would be most unlikely to give rise to locking of the joint.

The most constant symptom of a displaced

[1] Read before the Clinical Congress of Surgeons of North America, London July 28, 1914.

Fig. 1.

or fractured semilunar is a sudden inability to extend the knee. This very generally comes on immediately after injury, and less frequently it does not. I have seen many cases where no story of locking could be obtained as occurring at the time of accident, but it has occurred at varying periods later. This may sometimes only appear so because of the difficulty an injured patient has in analyzing his symptoms. Avoiding this fallacy we may be assured that in an appreciable number of cases the locking is for the first time complained of long after the initial injury. This fact is important from its legal aspect. The most frequent cause of the displacement or fracture is strain thrown on the internal lateral ligament while the knee is flexed and the tibia rotated outward. In rare instances I have known a displacement occur while the knee is fully extended. The force necessary to cause the derangement in a first injury is usually severe and the pain is acute. The injury may often be noticed on the football field. The athlete drops and rolls on the ground nursing the knee. Assisted he hobbles off the ground with his knee flexed. When he arrives home the joint is painful and distended. If the cartilage is still displaced, its reduction gives considerable relief from pain. The tender points of pressure are over the internal lateral ligament and over the anterior horn of the internal semilunar. Any attempt to abduct the limb at the knee is acutely painful. Forced extension of the knee is painful over the site of displacement. I maintain that if an injured semilunar is rationally treated after its initial displacement it stands a good chance of being completely cured — a much better chance than it does at any later period. If the reduction be immediate and efficient and the limb be kept fully extended, there is every reason to hope for good union. The first displacement is not often accompanied by any degenerative change. Reduction, however, must be absolute. All movements of the cartilage must be prevented until union of the torn structures is complete and no lateral strain must be allowed until the lateral ligament, so often injured, has had time to effect a recovery. There are many ways of reducing a cartilage, but if an anæsthetic be not used I have always thought it wise to summon the assistance of the patient himself. I first fully flex his knee and rotate it inwards. I then tell him at the count of three to forcibly extend his own knee while we help him by pressure from without. In this way he materially assists the surgeon and simplifies the reduction. In this manner I often reduce displacements of several weeks' duration. The reduction can usually be felt. If the reduction is complete, the patient usually knows definitely and at once, and the surgeon, if wise, will abide by the expression. If the patient tells you the cartilage is still out, he is generally right, and it is best to believe him. In all recent displacements, after reduction the knee should remain fully extended. If the knee does not remain completely extended, the displacement is not corrected. Such a joint with a clear history of semilunar injury and strained or ruptured internal lateral ligament should be treated by complete rest for four or five weeks. Instead of this the patient is usually allowed to get up and walk in a week or a fortnight. This is a mistake and is the outcome of very indifferent surgery and in a majority of instances lays the foundation for a series of recurrences. The cartilages can only be

retained in a fixed position when the limb is fully extended. In all rotary and lateral movements of the joint the cartilages participate. Rest of the limb in the fully extended position is therefore indicated, and as long as the effusion lasts the patient should be recumbent. Prolonged effusion relaxes by elongation all the protective structures of the joint; we should therefore aspirate should absorption be retarded. Elongation of the quadriceps with subsequent weak knee is closely associated with prolonged and recurrent effusions. Massage can be practiced while the knee is being rested, and still more valuable is to encourage the patient to practice contracting his quadriceps without flexing the joint. I am sorry to dwell so long upon the treatment of the initial lesion, but it is perhaps the most important point I have to make, and perhaps the most neglected. Unfortunately many of us become obsessed with the alleged advantages of a hurried convalescence and the illusory fears of adhesions. They are only snares for the unwary. A little common sense should help us to realize that the best way to promote the healing of torn structures is not to put them on continual or even occasional strain. These arguments obviously do not avail us when dealing with recurring displacements. When the patient is up we should guard his internal lateral ligament from strain during walking. He should be directed to walk with his toe slightly turned in and his foot inverted. This is made easy by raising the heel of his boot on the inner side to deviate body weight from the inner to the outer lateral ligament just as we would do in an early case of knock knee (Fig. 1).

It is more common to see the case when the acute symptoms are over or when several recurrences have taken place. We have to depend then upon the history, which is usually definite enough. First we hear of an injury; it may be severe or very slight; it usually refers to abduction of the foot, to flexion and external rotation of the tibia. Locking of the knee may have occurred on the first occasion or not — synovitis practically always. Even when locking has not occurred, a giving way or slipping is referred to. The story of a

Fig. 2.

reduction makes the diagnosis complete. If the knee be examined a few weeks after the accident, the effusion will have gone, but there is often pain on pressure over the internal lateral ligament and above the tibial margin over the anterior horn of the semilunar. On slight hyperextension of the knee pain is often felt in front of the joint. At a still later stage recurrences and fresh effusions may have occurred accompanied by locking of the joint, the pain on each occasion being capable of definite localization. Locking is the most definite and reliable symptom, and unless it occurs an element of doubt must always remain. One frequently finds a fractured or displaced semilunar where there has been no clear history of locking, but the discovery is made, if not with surprise, with a distinct sense of relief. The patient will often only be prepared to admit to a something yielding on the inner side of the knee which gives him

Fig. 3.

Fig. 4.

a sense of insecurity. This may involve only a momentary inconvenience or it may occasionally be accompanied by synovitis. On other occasions the patient states that he feels something slip in and out, merely giving him a sense of insecurity. The one constant fact should remain, namely, that the patient is always definitely clear that the sensation does not change from place to place. The various displacements are often said to be accompanied by a click.

Fig. 5.

There is no time to deal with the exceptional case which makes the surgery of the knee-joint so fascinating. It is often impossible to diagnose and can only be investigated by operation. Amongst such I have found the external cartilage on the inner side of the knee and I have found the fractured end of an internal cartilage lying on the outer side just internal to the external lateral ligament. I have found cartilages so split up that different segments of the same cartilage would be displaced at separate times, giving rise to distinctive symptoms. Frequently I have found two separate lesions either of which would account for the symptoms, and unless both were rectified the operation might have failed. Sometimes fringes and lipomata and pedunculated semidetached bodies (Fig. 2) have been present when I have expected a displaced cartilage, and I have sometimes even had to close my wound without having remedied any defect. These confessions show you that the knee is sometimes as secretive as the abdomen.

Although these surprises take place, the diagnosis of a displaced semilunar is comparatively a simple matter. It is liable to be confused with certain pathological conditions,

Fig. 6.

Fig. 7.

of which the most common are: synovial fringes, loose bodies, lipomata, and extra-articular osteomata.

In synovial fringes the symptoms are less acute in their primary onset. The pain is quite local and is not participated in by the internal lateral ligament. Creaking in the joint is common and effusion almost invariably follows each nipping. There is usually in the recurrent case a thickening on each side of the ligament of the patella, due to hypertrophy of the postpatellar pad. In cases of recurrent synovitis of the knee with thickened postpatellar pad, accompanied by occasional twinges in front of the joint, synovial fringes may be expected attached to a postpatellar pad (Fig. 3).

Loose bodies lock the knee sometimes but usually only for a brief moment. The symptoms are sharp but not acute. They can always be differentiated because unless pedunculated they can be isolated in different parts of the joint, although they usually have a favorite resting place. They can generally be demonstrated by radiography (Fig. 4). I have known lipomata to lock the knee, but the symptoms they produce are rarely acute. They are often accompanied by painless effusions and can often be felt in the pouches.

A careful examination will usually reveal an osteoma. It can be felt and radiographed. It is the means of locking a joint when a muscle or tendon slips over them. The locking is never accompanied by effusion.

There is a type of knee which clicks on full extension, and wherever you place your finger the clicking seems there. This is sometimes due to a nodular condition of the anterior portion of the semilunar, but often it will be found associated with a slipping in and out of the external cartilage, very clearly to be felt by placing the finger between the bones.

I hold decided views on the subject of operation. In the first place I refuse to operate upon any case whom I see at once the victim of a first displacement, as so large a porportion of cases get well under appropriate treatment. I do not encourage operation in cases where the recurrent trouble is painless and is

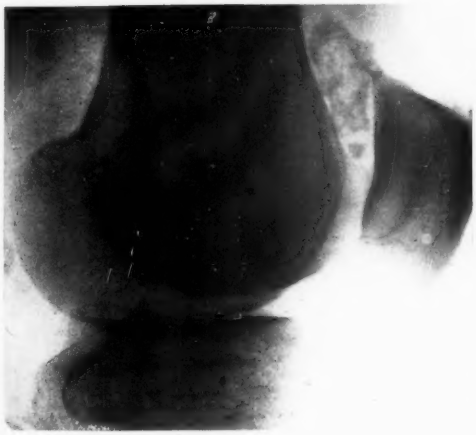

Fig. 8.

never followed by effusion in the joint. I strongly advocate operation where the recurrence is sometimes followed by acute symptoms, and I encourage it in all recurrent cases where a strenuous athletic life is a means of livelihood or a physical necessity. Operation is a positive necessity in the case of men who work or stand in positions where a yielding knee may mean disaster. Age is not necessarily a contra-indication. I have operated upon a girl of thirteen and a man of sixty.

An argument in favor of operation is the occurrence of tubercle and so-called rheumatoid trouble as a direct result of the irritation of a displaced cartilage. I have published several such instances.

If I decide to operate, I prefer to do so with the knee flexed to right angles so that it need not be further flexed during the operation. The most convenient way is to have the limb hanging over the end of the operating table (Fig. 5). Some thicknesses of gauze, squeezed out of a solution of biniodide of mercury, is wrapped round the joint and the incision is made through the gauze, the cut edges of which are fixed into the wound. In this position it is not necessary, excepting in very stout people, to make the incision longer than an inch and a half. The incision I now employ is nearly transverse, commencing just behind the ligament of the patella and traversing slightly above the tibial border. Through this small opening a most excellent view can be obtained of the joint. The interior of the joint is then inspected with the aid of retractors. The finger should never enter the joint. Neither the surgeon nor the assistant should be allowed to touch the wound except with sterile instruments. The sutures for the capsule should be handled on forceps, the edges of the capsule being secured by a blanket stitch. The cartilage may be found in almost any conceivable position. It may be split along its inner margin; it may be fractured; it may be detached anteriorly; it may be turned inwards like a bucket handle with its convexity inwards; it may be nodular; the posterior part may be in front; the anterior portion may be loose and nodular; it may be attached at its extremities and free along the whole or part of its outer border; it may be firmly fixed with its inner border frayed and serrated; the anterior part may be ground away or found quite loose as a separate body; it may look quite normal but its moorings will be found loose, or the posterior part may be split, which can only be discovered by detaching the anterior portion and drawing the cartilage into the middle of

Fig. 9.

the joint. The examination should be gentle and it is made easier by the use of a small blunt hook. It is only necessary to remove the loose portion of cartilage if the remainder be firmly attached. If it be decided not to remove the whole cartilage, care should be taken to make the section without drawing upon the stump; otherwise it will be loosened and give rise to symptoms of recurrence. The capsule should not be closed until a search has been made for fringes, tabs, or other possible sources of derangement. I always apply a tourniquet and never tie a vessel nor drain the wound. Effusion, if it occurs, is usually very trivial if the operation has been done gently. As no structures of any importance to the stability of the joint have been severed, walking may commence in ten to fourteen days, the joint being protected for another week.

Loose bodies of whatever type should be removed. An endeavor should first be made to localize and fix them. This should be done immediately before the anæsthetic, when the patient's help may have to be invited. His hands should be sterilized and he should wear

Fig. 10.

Fig. 11.

a mask and rubber gloves and the fixed body should be placed in the keeping of a reliable assistant. The knee should be kept extended during the operation.

These loose bodies are often found in connection with rheumatoid arthritis and should be removed whenever practicable (Fig. 6). This may involve splitting the patella longitudinally to obtain a good view of the interior of the joint (Fig. 7). Loose bodies are frequently found at the back of the joint and obstruct flexion and sometimes extension (Fig. 8). These cannot be effectively removed by an anterior incision and it will be necessary to approach the joint from behind. By reason of the narrow communication between the anterior and post portions of the joint they are not prone to travel if they should prove of any size. Their removal is not difficult. An incision is made through

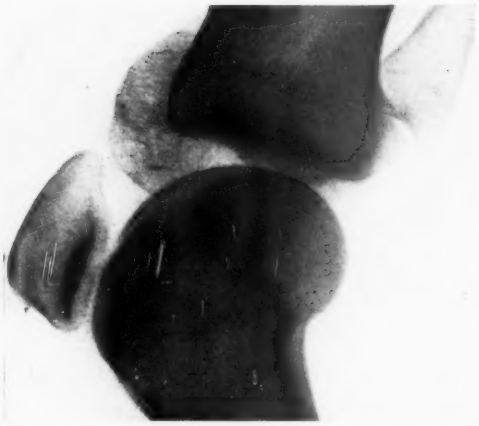

Fig. 12.

the popliteal space, the nerve and vessels being kept to the outer side, and usually the loose bodies can be felt through the capsule. This route has also been described by my friends Brackett and Osgood.

I have many times operated upon joints that became locked and obstructed by the slipping of muscles or tendons over exostoses around the knee. The slide shows such a case (Fig. 9). The patient, a good athlete, was frequently pulled up when running with a pain at the back of his joint, which I ascribed to an external semilunar. The knee on occasions locked. An X-ray revealed a pedunculated exostosis which obstructed the vastus. When removed it was found to be surrounded by a bursa containing fibrous masses.

This slide (Fig. 10.) will serve as a type of several such cases upon whom I have operated. The patient usually gives the history of a knee which slips at the back. This takes place only during unusual or active exercise. The knee sometimes completely locks and is often very difficult to reduce. Generally the symptoms are not severe, merely a sense of discomfort and slight slipping. The patient falls, gets up again, and feels the back of his knee, and then goes on with his game. Sometimes it is the biceps which is hampered, at other times the inner hamstrings, and in one instance I removed a pedunculated

Fig. 13.

exostosis which often became entangled with the inner head of the gastrocremius. Here you see an osteoma (Fig. 11), which ceased to trouble as soon as it fractured. Until then it occasionally obstructed the sartorius. The next plate shows a flattened osteoma which gave rise to symptoms suggestive of an injured semilunar, really due to its contact with the sartorius and semitendinosus, and the osteoma shown in the next slide (Fig. 12) caused a slipping of the knee on many occasions until it was removed. More rarely derangements may arise from sharp exostoses over the adductor tubercle, as shown on the slide (Fig. 13).

The diagnosis of such cases is easily made. They can be felt by the finger and demonstrated by the X-ray.

Fig. 14.

Fig. 15.

Fig. 16.

These cases are only a few of a large number which prove the part osteomata may take in disarranging the mechanism of the knee. Osteomata are so often found causing no symptoms that their evil conduct may sometimes easily be overlooked.

There are two conditions to which I would make a brief reference, as they give rise to very considerable disability. I allude to rupture of the crucial ligament and fractures of the tibial spines. The diagnosis of ruptured crucials is simple if we remember their functions.

The anterior crucial ligament is tense when the knee is fully extended and prevents the tibia from being displaced forwards on the femur.

The posterior crucial ligament is tense in complete flexion and prevents the tibia from being displaced backwards on the femur.

Both ligaments check inward rotation of the tibia. Hence, if after an injury of the knee the tibia can be displaced backwards or forwards or rotated inwards in the extended position, an injury of one or both crucial ligaments may be assumed.

If in the extended position the tibia cannot be displaced forwards it may be assumed that the anterior crucial ligament is not torn.

If in full flexion the tibia cannot be displaced backwards, the posterior crucial ligament is not ruptured.

The diagnosis, therefore, of ruptured crucials is not difficult if we exclude those cases of abnormal mobility due to elongation or destruction of the ligaments associated with long continued effusion into the joint or with changes associated with Charcot's disease. A large experience of dislocations gives me the authority to state that if injuries resulting in ruptured crucials be treated by rest to the joint for several weeks an excellent recovery will usually result. It is therefore unwise to attempt their restoration by operative means.

Fractures of the tibial spines, of which I have seen many cases, may or may not be associated with rupture of the crucials (Figs. 14, 15, and 16). The most constant sign of this fracture is an obstruction to full extension. The block feels like a definite bony obstruction and is quite different from the locking which occurs when a dislocated semilunar or a synovial fringe is nipped. If this block should not be present the case should be treated by rest and fixation. If there be a block, then with the leg hanging over the table the patella should be split longitudinally and the post-patellar pad removed together with the fractured spine.

Mr. President and Gentlemen: I feel I have placed the subject of derangements of the knee before you in condensed and hurried fashion. The lesions are probably much more common with you than your literature suggests. If by good fortune the clinical suggestions I have offered you should prove of practical use I shall feel more than ever grateful for the privilege of addressing you.

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# OPERATIVE TREATMENT OF ANKYLOSIS OF THE MANDIBLE

## With a History of the Operation and an Analysis of Two Hundred and Twelve Cases

By V. P. BLAIR, A. M., M. D., St. Louis

MY object in presenting this subject of ankylosis or chronic limitation of movement of the lower jaw is to emphasize the fact that this is by no means an unexplored field and that sufficient work has been done and a sufficient number of cases have been reported to standardize the treatment of the various groups of cases of this class. Both our review of the literature and observations made upon our own cases have convinced us that practically all of these can be relieved, and that when properly operated this relief is permanent, restoring an open mouth and a functional lower jaw. The advanced age at which some of these cases present themselves and the length of time the ankylosis has persisted would alone be sufficient reason for a broad presentation of this subject.

In this presentation I will take up certain points as exemplified in the general literature, citing our own cases and ideas only when they are pertinent.

### AGE OF THE PATIENTS AND THE DURATION OF THE FIXATION

In the reported cases the ages at which the patients were treated varied from twenty-two months to fifty-seven years. A little over 25 per cent of these patients were ten years or under, while half the remainder were over twenty years; and cases between thirty and forty years are by no means rare. Our youngest operated case was five years old at the time we did a double excision of the condyles. The oldest was about sixty years when he came for treatment.

### EXCITING CAUSE AND AGE AT WHICH IT OCCURRED

The age at which this took place varied considerably, but in the great majority of cases where the age was given it was under ten years. In one case injury at birth was the supposed cause. By far the most common single cause was trauma; this accounting for nearly fifty per cent of all cases. The great majority of these injuries were not open wounds, and by far the most common form of injury was a blow or fall on the chin. L. W. Orlow[1] found that in one hundred and four cases which he analyzed only twenty-nine percent were caused by trauma, but this does not correspond to the findings in a review of all reported cases.

Next to injury comes scarlatina, usually with suppuration in or about the joint, which accounted for about one-fifth of all cases.

Next in frequency is suppuration in or about the joint or otitis media, the specific cause not being stated. In a few cases the suppurative focus started about a tooth. Among the other infectious diseases, typhoid was the most prominent factor, but pneumonia, measles, variola, diphtheria, syphilitic ulceration and undiagnosed febrile disturbances are mentioned in different cases.

In one of our cases the exciting cause was, in all probability, a gonorrhœal arthritis, as the child had a gonorrhœal ophthalmia at the same time as the arthritis. Rheumatism and "rheumatoid arthritis" are put forward as causes, while noma and mercurial stoma-

[1] Ankylosis Mandibulæ veræ. Deutsche Ztschr. f. Chir., 1902–03. lxvi, 399.

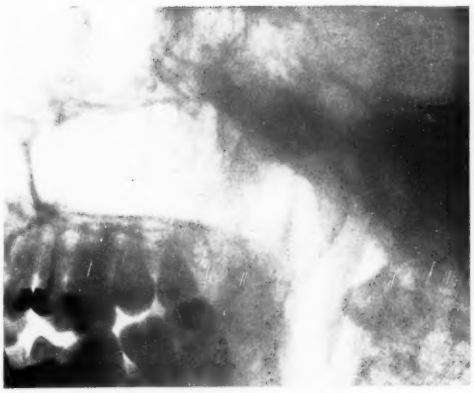

Fig. 1. A normal condyle in the glenoid fossa.

titis account for a few cases. We have seen several cases with multiple joint lesions that would come under the heading of hypertrophic arthritis or rheumatoid arthritis.

### CHARACTER OF THE ANKYLOSIS AND ITS CLINICAL DEVELOPMENT

In the cases drawn from the literature bony ankylosis would be inferred as the cause in the great majority of the cases. Next in frequency are fibrous bands in the joint while cicatricial bands in the cheek come next. In one case a scar band attached to the coronoid process is given as the cause, while in another a tumor was attached to the zygoma.

Among our cases, two were solid bony ankylosis on one side, and in these cases the coronoid process and condyle were represented by a solid bony mass fused to the base of the skull with no sigmoid notch and no glenoid fossa. In four of them there was a short, close, fibrous ankylosis of the joint with considerable change about the condyle and coronoid. In most of the cases the sigmoid notch was entirely absent, the ramus being continued up in its full width, ending in a broad, flat, rough base that was closely attached to a similar flat surface at the site of the glenoid fossa. In two there was apparently less bony change in the joint. In one case there was considerable limitation, due possibly to the dislocation of the interarticulation of the interarticular fibrocartilage. It came on suddenly while an injection was being made for a facial neuralgia and continued without change. In one case the ankylosis was apparently due to a very large, strong, styloid process that impinged the posterior border of one ramus of a receding jaw. Cicatricial bands in the cheek limited the opening in three cases.

Fig. 2. A normal condyle rising on the articular eminence; mouth partially open.

The development of the ankylosis has, in all of our cases, been gradual. There was the injury, or the arthritis, and later it was noticed that the amount of opening was limited. Gradually this decreased until there was complete or almost complete closure. The case of supposed dislocation of the cartilage, cited above, was an exception to this rule. In all, attempts had been made to force the mouth open, and while these may have been for a time partially successful, their result was only temporary. There seems to be a strong tendency, for what at first must have been a simple fibrous ankylosis, to turn into a complete or almost complete bony ankylosis. Where the ankylosis

Fig. 3. Close fibrous ankylosis with excessive periarticular exostosis. True bony ankylosis gives somewhat the same picture.

Fig. 4. Close fibrous ankylosis of the whole of the upper end of the ramus. The sigmoid fossa has disappeared.

was due to changes in the joint that occurred during the growing period there was always a lack of development of the lower jaw with a receding chin. This has been cited by Cryer and a few others and was noted in five of our cases. The cause of this is not clear. If it were due directly to the destruction of one epiphyseal cartilage it would appear that the lack of development in a unilateral ankylosis should be unilateral, but this has not been the case. Another possibility that has suggested itself is that abnormal strain of the hyomandibular muscles in their strenuous efforts to open the mouth may have influenced the shape of the jaw.

*Symptoms.* The chief symptom is the inability to open the mouth freely. There may be a limited opening or the mouth may be absolutely closed. In the latter case the mouth is apt to be foul and solid masses of tartar may cover the buccal surfaces of the upper and lower molars continuously. If there is a somewhat close unilateral fibrous ankylosis, as the mouth opens the chin deviates to the ankylosed side. The reason for this is that while the attempt is made to open the mouth the condyle on the unaffected side travels forward on the articular eminence, while on the ankylosed side there is only a slight twisting of the ramus on its long axis. This is very distinct, and before the days when the X-ray was adequate for showing the condition of the joints, we were able by it to definitely determine which joint was affected. The recession of the chin in early ankylosis has already been referred to. The general health is usually impaired.

*Treatment.* The simplest form of treatment and one that has been resorted to in probably all cases is the forceful distention of the opening. It may be done gradually with a dilator, rubber or pine wedges, or with Laminaria tents. The dilatation may be done forcefully under an anæsthetic. In one reported case gas was administered an incredible number of times. However, the review of the literature and our own observation lead us to conclude that simple dilatation is for one reason or another rarely satisfactory. It can do no good in bony ankylosis, and unless it is persisted in for an indefinite period it will be of no permanent advantage in the ordinary close fibrous ankylosis or when there are dense scars in the cheek. In simple, light joint adhesions dilatation may be all that is needed.

In considering the operative treatment we must distinguish between cases where the joint is affected directly and those in which the limitation is due to scars in the cheek that bind the upper to the lower jaw, though an Esmarch operation is designed to relieve

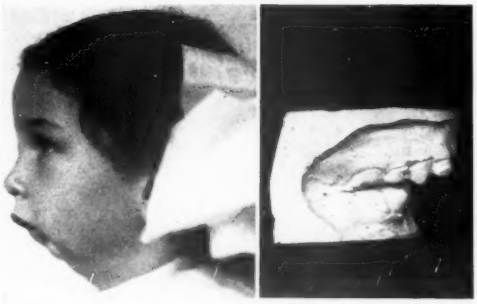

Fig. 5. Profile and dentures of a child five years old who had a double fibro-osseous ankylosis existing for two years, showing the retraction of the mandible. Reconstruction of both joints two years ago and though there is a fair amount of opening, there seems to be little development of the mandible.

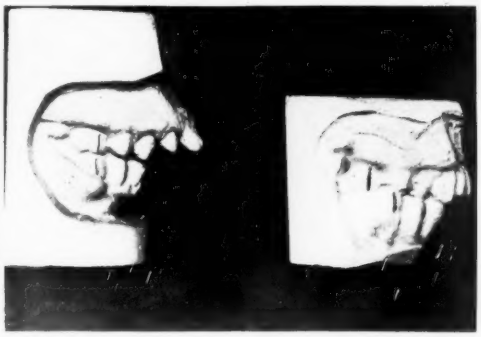

Fig. 6. Plaster reproduction of the dentures showing the relation of the jaws in a case of close fibrous ankylosis during the growing period and the amount of correction of the mandibular retraction that was accomplished at the time of the operation for ankylosis.

both conditions. For cheek scars which are usually confined to the mucous surface probably the first method attempted was the simple division or excision of the bands, but this is not efficacious, for the bands soon unite again or new scar forms at the site from which they were excised.

Esmarch in 1855, before the Congress at Göttingen, proposed his operation, which consists of the excision of a wedge-shaped piece of bone, three-quarters of an inch long, from the body of the jaw in front of the binding scars. This gives a good functional result but is not the best means at our disposal.

In 1862 Clendon, of the Westminster Hospital of London, devised a pair of silver shields that fitted over the molar teeth and had flanges which extended down into the reëstablished bucco-alveolar cul-de-sac. These were used to protect the teeth while wedges were being inserted and the flanges seemed to prevent the scar bands from becoming directly reattached to the jaw.

Dr. Ewing Mears of Philadelphia divided scar bands by surrounding them with a ligature which was tightened each third day. By this means and with dilatation he got an opening of three-quarters of an inch.

Brophy has inserted a ring through the tissues surrounding the scar band as has been recommended for pharyngeal adhesions, later cutting the band at the site of the ring after the ring tract has epitheliated.

It would seem most reasonable to excise the scar bands and replace them with soft epithelial tissue. This has been done with strips of mucosa obtained from within the mouth, but these strips may not be easily obtainable. A plan which we have used repeatedly where the mucous lining of the mouth was deficient, and applied with a satisfactory result after the excision of limiting scar bands, is the transplantation of a skin flap from the neck attached by a pedicle and brought into the mouth through an incision in the lower fornix of the cheek. The flap is sutured in place and ten days or two weeks later the pedicle is cut and the defect in the upper part of the neck repaired. (Detailed description of this method is given in Blair's Surgery & Diseases of the Mouth.) The skin, which must not be hair-bearing, adapts itself kindly to the new situation, and it seems the most reasonable and satisfactory method of dealing with extensive intra-oral scar bands.

Busch[1] reports a case in which Korte repaired the defect left after excision of scar bands by means of flaps obtained from within the mouth. Murphy[2] has reported a similar case. It would seem probable, however, that this method is applicable only to those cases in which the bands were confined to the posterior part of the cheek.

[1] Deutsche med. Wchnschr., 1907, xxxiii. 185.
[2] Surgical Clinic, 1913, Vol. II, No. 3, 405.

Fig. 7. The author's incision for reconstruction of the mandibular joint. The heavy lines show the amount of anæsthesia resulting. There is also paralysis of the occipitofrontalis muscle.

For ankylosis directly affecting the joint, that will not yield to simple dilatation, (and in few cases will dilatation be permanently effectual) an excision of the joint or the removal of a section from the body of the ramus will be necessary. (Spanton once divided scar bands around the joint subcutaneously with a tenotome but the ankylosis returned.)

Esmarch's operation, which is the excision of a fair sized piece of the full thickness of the bone at, or in front of, the angle, was one of the first to attract general attention and is still popular. For further historical data, see note and chart at the end of the paper.

The more rational one, but one more difficult of execution has been credited to Bottini,[1] and consists in the removal of the condyle or the condyle and coronoid process when both are involved; often there is but a mass of bone uniting the ramus to the base of the skull.

George Murray Humphrey[2] in 1854 excised the condyle for a diseased condition of the process that was distorting the jaw.

Excisions from or sections through any part of the ramus or body have been made, but unless a considerable piece of bone is removed or unless some material is interposed between the cut ends these may reunite. Various materials have been used for insertion between the bones—metal, gutta percha, rubber plate, neighboring muscle tissue, or foreign animal membrane. We have always used a flap of the subcutaneous temporal fascia and believe it admirably adapted to the purpose. The method of approach has varied somewhat. For operating near the angle or on the lower part of the ramus the incision is usually made along the lower border of the jaw and the posterior part of the ramus. For approaching the neighborhood of the joint, numerous different incisions have been used. The chief essential of the incision is that it renders the joint accessible and that it does not destroy the nerve supply to the orbicularis palpebrarum. In the operation we employ, we have found it impossible to preserve the nerve supply of the anterior belly of the occipitofrontalis muscle.

In general the incisions that have been employed, as given by L. W. Orlow,[3] are:

1. Vertical incision first used by Bottini.
2. Horizontal.
3. Bassini's arched incision with convexity forward and downward.
4. Alexander's tongue-shaped incision over the masseter muscle.
5. Incision, one part vertical in front of the ear, the other parallel to the zygoma.

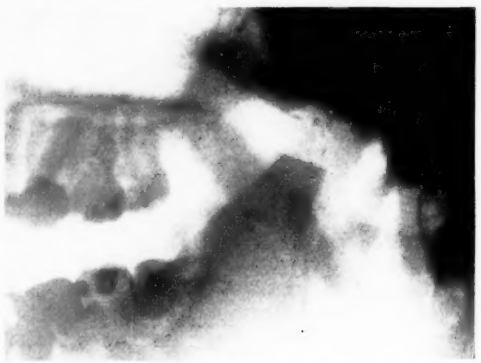

Fig. 8. Showing the result of excision of an ankylosed joint. The oblique shearing off of the anterior upper part of the ramus facilitates free movement.

[1] Gior. d. r. Accad. d. Med. d. Torino. Serie III, Vol. XI, 1872, 549.
[2] Assoc. M. J., Lond., 1856.
[3] Deutsche Ztschr. f. Chir., 1902-03, lxvi, 390.

6. Humphrey's upper angle incision.
7. Abbe's lower angle incision.
8. Hidrich's and Cabot's cross incision.
9. Kraske's combined arched and horizontal incision.

Mears divided the ramus above the last molar from within the mouth and twisted out the upper fragment. The incision which we have employed in all of our cases differs somewhat radically from those presented elsewhere, and has the advantage that it is almost completely within the hair-line and allows of the making of a properly fashioned flap of fat tissue for the construction of the new joint. The skin flap, with a very little subcutaneous tissue, is turned downward and forward. Then a similar flap is made of the subcutaneous tissue down to the temporal fascia; this latter should contain the trunks of the temporal artery and vein uninjured. The parotid gland containing the branches of the seventh nerve and the masseter muscle are stripped downward *en masse* with an elevator, the site of the joint and the upper part of the ramus are exposed, the condyle, coronoid, and upper part of the ramus are removed with burrs, biting forceps, and chisel until there is a space of three-quarters of an inch between the ramus and the skull. Next, the fat flap still attached at its base is sutured to the now exposed internal pterygoid muscle, so that it rests between the cut portions of bone. The skin flap is sutured in place and a rubber dam drain is let out through the lower part of the wound. After cutting the bone, the mouth is forced open with a specially constructed dilator. If the mouth will not yield sufficiently, then the operation must be repeated on the other side. We have had but one case of double ankylosis, although in one case, a patient thirty-five years of age who had had a complete unilateral ankylosis for fifteen years, the good joint was very stiff and required careful stretching with considerable force. In another case while attempting simple dilatation we fractured the jaw at the site of an unerupted third molar and after the fracture united, excised the ankylosed joint. Though it causes discomfort we prefer to dress the mouth open for a week.

Before After

Fig. 9. Shows the condition resulting from ankylosis during the growing period and the result of the operation with transplantation of cartilage into the chin. She has a permanent opening of one inch, two years later.

This operation, which we presented at the St. Louis Medical Society in 1910, we have employed in five cases, and the results are such that we have no inclination to modify it in any essential detail, except where there is excessive recession of the chin. In the latter case the operation, as described above, is done on the ankylosed side and on the other a simple subcutaneous section of the ramus is done with a Gigli saw. Then the body of the jaw is drawn forcefully forward and held in this new position by wiring the lower to the upper teeth. These wires remain in place twelve weeks. Later gradual stretching of the new joint is done with rubber wedges or bottle stoppers. In two cases we have rounded out a deficient mental eminence by implanting a section of costal cartilage in the soft tissues of the chin.

*Results.* The immediate result where the mouth was dressed open was an opening of three-quarters to one inch. By the use of a rubber bottle stopper this opening is preserved or even increased in the next two months; later the opening gradually increases until it may reach one and one-half inches. In a child of five years, with a double ankylosis, we were unable to get more than three-quarters of an inch opening and a rubber dilator had to be used a long time to maintain this, but I believe in time this amount of opening will increase. In

Fig. 10. Shows the condition resulting probably from noma, the jaws being bound tightly together by scar tissue; and the result of a plastic operation and transplantation of a flap from the neck to replace the scar tissue inside of the cheek.

some of the reported cases greater openings have been obtained. According to Orlow,[1] in cases analyzed by him there have been recurrences in twelve per cent of the cases, but many operations in the past have been very inadequate. If he were to include operations which consisted in simply stretching the adhesions and fibrous bands, the number of recurrences would be much nearer to one hundred per cent.

The objects of the operation are to allow the mouth to open sufficient for function, to restore the lateral or grinding motion of the jaw, and to allow inspection and cleansing of the mouth. Not the least part of the suffering of these patients is from toothache. An opening of one-half inch is not sufficient for any of these purposes, but add just a little more and all of them can be carried out fairly well. A gentleman, at the age of about sixty, was sent to me because of an ankylosis that permitted an opening of eighteen thirty-seconds of an inch and which caused him great annoyance. With the help of Dr. J. A. Brown, of this city, we constructed a pneumatic dilator which his dentist used intermittently for about one year and got a permanent opening of three-sixteenths of an inch more. With this "he is able to eat bread and butter without getting it all over himself" (quoted from his dentist's letter). This case is cited simply to show how much a slight gain on the measuring stick may really be in function.

[1] Deutsche Ztschr. f. Chir., lxvi, 399.

Fig. 11. Shows scar bands in both sides of the check binding the jaws together. A double transplantation from the neck was done.

*Mishaps and complications.* Aside from simple wound infection the most common post-operative complication is a temporary paralysis of the whole or a part of the seventh nerve. In the incision we describe the branch to the occipitofrontalis muscle will be cut and the patient will be unable to wrinkle the forehead on that side. This has been permanent in our cases. A more general affection of the nerve has frequently resulted from stretching or from wound infection, but this usually passes off in five weeks. In one case we injured some fibers of the orbicularis palpebrarum and for several months the patient was unable to close the eye completely but finally fully recovered. One operator divided the trunk of the seventh nerve and had a permanent paralysis. This would seem to be an almost unnecessary accident. In several cases tracheotomy had to be performed during the operation and several operators have done it before attempting the operation. While we

| Name and Reference | Age and Sex | Date of Operation | Duration of Ankylosis | Predisposing Cause | Character of Ankylosis | Preoperative Movement and Opening | Previous Treatment | Occlusion before Operation | Operation | Mouth Dressed Open or Closed | Complications | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V. P. Blair. J. Am. M. Ass., liii | 21, F. | 1905 | Over 10 yrs. | Brushing injury of face | Obstruction to movement by adnormally large styloid process | 1/8 inch | Forceful dilation | Lower jaw receding | Rami sawed through subcutaneously body of jaw forward and wired in place for twelve weeks. This increased the distance between the angle of the jaw and the obstructing styloid | Closed | None | 5/8-inch opening |
| V. P. Blair. Unreported | 35, F. | Dec. 1912 | 23 yrs. | Multiple osteomylitis | Osseous of left side | None | None | Fair | Blair operation on left side. Right side dilated | Closed | None | 1 inch Oct. 1913. Good lateral movement |
| V. P. Blair. Unreported | 10, F. | Feb. 1913 | 3 mos. | Injury to jaw 2 ys. prev'sly | Fibro-osseous | 1/4 inch | None | Slight distortion | Forceful dilation under anæsthetic | Closed | None | 1 1/4-inch opening |
| V. P. Blair. Unreported | 19, F. | | 6 yrs. | Hypertrophic Arthritis | Fibro-osseous | 1/2 inch | None | | Not operated | | | |
| V. P. Blair. Unreported | 66, M. | | 1 yr. | Occurred during injection for Tic Douloureux | Possible dislocation of inter-articular fibro-cartilage | 3/4 inch | None | O. K. | Not operated | | | 3/4-inch opening |
| V. P. Blair. Unreported | 34, F. | | | Syphilitic necrosis of jaw | Fibrous | 5/8 inch | None | Distorted | Not operated | | | |
| V. P. Blair. Not reported | 3, F. | | | Multiple gonorrhœal arthritis | Fibrous | 1/4 inch | None | Retracted jaw | Not operated | | | |
| V. P. Blair. Unpublished | 57, M. | | 12 yrs. | Hypertrophic arthritis | Fibrous | 1/4 inch | None | O. K. | Gradual dilation with dilator | | None | Open 3/4-inch |
| V. P. Blair. Surgery of Mouth and Jaws, 1912 | 16, F. | 1911 | 13 yrs. | Gonorrhœa | Fibro-osseous right side | 3/8 inch | Dilation under chloroform at 3 yrs. | Receding lower jaw | Excision of upper end of right ramus and transplantation of superficial temporal fascia. Left ramus sawed transversally and body of mandible brought forward. Rib cartilage transplanted into chin | Closed | None | 1 yr. later increasing good profile and good lateral movement |
| V. P. Blair. Surgery of Mouth and Jaws, 1912 | 5, F. | 1911 | Over 2 yrs. | Injury | Fibro-osseous. Both sides | 1/4 inch | None | Undeveloped retracted lower jaw | Blair operation on both sides | Open | None | 11/16-inch opening. Chin retracted |
| V. P. Blair. Unpublished | 16, M. | 1909 | 12 yrs. | Calomel? Noma? | Scar bands in cheek | None | None | Fair | Scars excised, cheek repaired externally and lined with a skin flap from neck | Closed | None | Case lost sight of. Immediate res'lt 5/8-in. |
| V. P. Blair. Bull. of St. Louis Med. Soc., April, 1910 | 22, M. | 1910 | 11 yrs. | Trauma over joint | Fibro-osseous left side | 1/4 inch | | O. K. | Blair operation on left side | Open with 1-inch block | Permanent paralysis of anterior belly of occipito-frontalis of left side | 1 3/4-inch opening 18 mos. later; good lateral movement |
| V. P. Blair. J. Am. M. Ass., liii, and Surgery of Mouth and Jaws, 1912 | 23, F. | 1908 1911 | Over 17 yrs. | Scarlet fever and periarticular suppuration at 2 yrs. | Bony on right side | None | Uneffective dilation | Lower jaw receding | In 1908 sawed ramus subcutaneously on both sides, drew chin forward, wired jaws closed and transplanted costal cartilage to chin. Jaw retained new position but opening gradually decreased to 1/4 inch. Blair operation on right side. | | Temporary paralysis of of right orbicularis palpebrarum. Permanent paralysis of right ant. bellyof occipito-frontalis | 5/8-inch opening |

have always been prepared to do a tracheotomy, we have so far not found it necessary.

## CONCLUSION

It is our belief that, except in comparatively few cases, simple stretching is not a permanent nor an adequate relief for ankylosis of the jaw; but that a properly performed operation will give permanent relief with minimum discomfort and with very little risk to life and great benefit to the patient

### KEY TO REFERENCES

For the purpose of condensation the various cases are reported in abbreviated form, the numbers in each case referring to the numbers in the key below.

(1) Name and reference.
(2) Age and sex.
(3) Date of operation.
(4) Duration of ankylosis.
(5) Predisposing cause.
(6) Character of ankylosis.
(7) Pre-operative opening and movement.
(8) Previous treatment.
(9) Occlusion before operation.
(10) Operation.
(11) Mouth dressed open or closed.
(12) Complications.
(13) Result.

CASE 1. (1) Rochet. Arch. prov. de Chir., v, 5. (2) 10. M. (3) July 3, 1894. (4) 2 (?) yrs. (5) ?. (6) Bony, left. (7) ½ cm. between incisors. (8) ?. (9) ?. (10) Wedge of bone removed and muscle implanted. (11) ?. (12) None. (13) Recurrence.

CASE 2. (1) Rochet. Arch. prov. de Chir., v, 5. (2) 9, M. (3) Sept. 19, 1895. (4) 2 yrs. (5) Fall on chin. (6) Bony, left. (7) Few mm. (8) ?. (9) Atrophy of jaw. (10) Bone section of ascending ramus. (11) ?. (12) None. (13) Good.

CASE 3. (1) Rochet. Arch. prov. de Chir., v, 5. (2) 24, M. (3) ?. (4) 8 mos. (5) Gonorrhœal rehumatism. (6) Bony, left. (7) ½ cm. (8) ?. (9) ?. (10) Bone section, muscle implanted. (11) ?. (12) None. (13) 3 cm. opening.

CASE 4. (1) Hartley. Ann. Surg., Phila., 1911, April. (2) 10, F. (3) Jan. 5, 1909. (3) Mar. 6, 1909. (4) 6 mos. (5) Diphtheria and scarlet fever. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Bone section on right side. (10) Bone section on left side. (11) ?. (12) None. (13) Good motion.

CASE 5. (1) Hartley. Ann. Surg., Phila., 1911, April. (2) 17, M. (3) May 1910. (4) 4 mos. (5) Fracture. (6) Right bony. (7) ½ inch. (8) ?. (9) ?. (10) Excised condyloid process part of zygoma and temporal bone. (11) ?. (12) None. (13) Open 1¾ inches.

CASE 6. (1) Hartley. Ann. Surg., Phila., 1911, April. (2) 40, M. (3) ?. (4) 6 yrs. (5) Injury. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Bone section. (11) ?. (12) None. (13) Open 2 inches.

CASE 7. (1) W. J. Roe. Ann. Surg., Phila., 1903, Aug. (2) 18, M. (3) Dec. 2, 1901. (3) Dec. 9, 1901. (4) 10 yrs. (5) Fracture. (6) Bilateral. Bony. (7) 0.1 cm. (8) ?. (9) ?. (10) Callus removed on right. (10) Callus removed on left. (11) ?. (12) Temporary facial paresis. (13) Open 1¼ inches.

CASE 8. (1) W. J. Roe. Ann. Surg., Phila., 1903, Aug. (2) 18, M. (3) ?. (4) 13 yrs. (5) Injury. (6) Bilateral. Bony. (7) 0.3 cm. (8) ?. (9) ?. (10) Callus removed. (11) ?. (12) Tracheotomy. (13) ?.

CASE 9. (1) Mason by Swain. Med. Times Gaz. (2) 29, F. (3) ?. (4) 16 yrs. (5) Scarlet Fever. (6) Right Bony. (7) None. (8) Forced under anæsthetic. (9) ?. (10) Bone section. (11) ?. (12) None. (13) Good.

CASE 10. (1) Spanton. Lancet, Lond., 1881. (2) ?. (3) April 1880. (3) April 1881. (4) ?. (5) ?. (6) Bilateral. Fibrous. (7) ?. (8) ?. (9) ?. (10) Division of external lateral ligaments. (10) Similar. (11) ?. (12) None. (13) Recurred. (13) Fair.

CASE 11. (1) Spanton. Lancet, Lond., 1881. (2) 9, F. (3) Nov. 1879. (4) ?. (5) Scarlet Fever. (6) Bony. (7) ?. (8) ?. (9) ?. (10) ?. (11) ?. (12) None. (13) Able to eat.

CASE 12. (1) Sidney Jones. Lancet, Lond., 1894, Aug. (2) 18. (3) Dec. 1883. (3) Jan. 1884. (4) ?. (5) Injury (6) Bilateral. Bony. (7) ?. (8) Gags and plugs. (9) ?. (10) Bone wedge removed on right. (10) Bone wedge removed on left. (11) ?. (12) None. (13) Not good. (13) Open one inch.

CASE 13. (1) Richard Davy. Lancet, Lond., 1886, Sept. (2) 50, F. (3) Nov. 1878 (4) 1 yr. (5) Tooth abscess. (6) Left Bony. (7) Slight. (8) ?. (9) ?. (10) Excised condyle. (11) ?. (12) None. (13) Died.

CASE 14. (1) Richard Davy. Lancet, Lond., 1886, Sept. (2) 9, F. (3) Feb. 1870. (4) ?. (5) ?. (6) Left Bony. (7) ?. (8) ?. (9) ?. (10) Excised condyle. (11) ?. (12) None. (13) Good.

CASE 15. (1) Richard Davy. Lancet, Lond., 1886, Sept. (2) 47, M. (3) May 1885. (4) 14 mos. (5) Toothache. (6) Left Bony. (7) Slight. (8) ?. (9) ?. (10) Excised condyle and neck. (11) ?. (12) None. (13) Open ¾ inch.

CASE 16. (1) Heath. Brit. M. J., ii, 1884. (2) 32, F. (3) May 1883. (4) ?. (5) Rheumatism. (6) Left Bony. (7) ?. (8) Force. (9) ?. (10) Removed condyle, neck, and part of coronoid process. (11) ?. (12) None. (13) Satisfactory.

CASE 17. (1) Heath. Brit. M. J., ii, 1884. (2) 32, F. (3) March 1883. (4) 24 yrs. (5) Injury. (6) Right Bony. (7) None. (8) ?. (9) ?. (10) Removed bone wedge. (11) ?. (12) None. (13) Fair.

CASE 18. (1) Heath. Brit. M. J., ii, 1884. (2) 10, M. (3) Dec. 1883. (4) 8 yrs. (5) Injury. (6) Left Adhesions. (7) $\frac{1}{16}$ inch. (8) ?. (9) ?. (10) Removed part of zygoma and condyle. (11) ?. (12) None. (13) Open ½ inch.

CASE 19. (1) Heath. Brit. M. J., ii, 1884. (2) 9, F. (3) March 1884. (4) ?. (5) Measles. (6) Left Bony. (7) $\frac{1}{12}$ inch. (8) ?. (9) ?. (10) Bone resection. (11) ?. (12) Nerve injured. (13) Open ¾ inch.

CASE 20. (1) Heath. Brit. M. J., ii, 1884. (2) 16, M. (3) Dec. 1886. (4) 5 yrs. (5) Scarlet fever. (6) ? (7) ?. (8) ?. (9) ?. (10) Resection of ramus. (11) ?. (12) None. (13) Open $\frac{1}{16}$ inch.

CASE. 21. (1) Fred Page. Brit. M. J., ii, 1887. (2) 13, M. (3) May 28, 1887. (4) 4 yrs. (5) Measles. (6) Left Bony. (7) Slight. (8) Gag. (9) ?. (10) Removed condyle. (11) ?. (12) None. (13) Open full extent.

CASE 22. (1) Fred Page. Brit. M. J., i, 1889. (2) 9, F. (3) March 5, 1889. (4) 7 yrs. (5) Measles. (6) Right Bony. (7) Slight. (8) ?. (9) ?. (10) ?. (11) ?. (12) None. (13) Normal.

CASE 23. (1) Barker. Lancet, Lond., 1893, May. (2) 15, F. (3) Oct. 9, 1891. (4) 10 yrs. (5) Injury. (6) Left Bony. (7) ¼ inch. (8) ?. (9) ?. (10) Removed mass of bone and neck. (11) ?. (12) Temporary paresis. (12) Open 1¼ inches.

CASE 24. (1) Heath. Injuries and Diseases of the Jaw. (2) 27, M. (3) ?. (3) 4 mos. later. (4) 20 yrs. (5) Scarlet Fever. (6) Bilateral. Bony. (7) None. (8) ?.

(9) ?. (10) Wedge of bone removed from right. (10) Wedge of bone removed from left. (11) ?. (12) None. (13) ?.

Case 25. (1) Humphrey. J. Am. M. Ass., 1856, Jan. (2) 21, F. (3) 1884. (4) 2 yrs. (5) ?. (6) Right bony. (7) ?. (8) ?. (9) Displaced to left. (10) Removed condyle. (11) ?. (12) None. (13) ?.

Case 26. (1) Paul Swain. Lancet, Lond., 1894, July 28. (2) 22, F. (3) Oct. 11, 1892. (4) 11 yrs. (5) Scarlet Fever. (6) Bilateral. Bony. (7) None. (8) Operations in 1880 and 1811 (reported). (9) ?. (10) Triangular piece of bone removed from both sides. (11) ?. (12) None. (13) 2 yrs. later, normal.

Case 27. (1) Francis Stewart. Ann. Surg., Phila., 1904, March. (2) 6, F. (3) Sept. 28, 1903. (4) 22 mos. (5) Swelling and discharge. (6) Right Bony. (7) Complete closure. (8) Sequestrum removed. (9) ?. (10) Excision of bone from joint cavity. (11) ?. (12) Slight palsy of palp. orbicularis. (13) Normal.

Case 28. (1) Willard, DeForest. Ann. Surg., Phila., 1904, March. (2) Child. (3) Oct. 19, 1903. (4) 3 yrs. (5) Injury. (6) Adhesions. (7) None. (8) ?. (9) ?. (10) No incision—steady pressure under ether. (11) ?. (12) None. (13) Normal.

Case 29. (1) J. Wyeth. St. Louis M. Brief, 1903, Feb. (2) 34, M. (3) Nov. 19, 1902. (4) 2 yrs. (5) Injury. (6) Bony left. (7) Complete closure. (8) ?. (9) ?. (10) Removed section of bone ¼ inch in width. (11) ?. (12) None. (13) Normal.

Case 30. (1) Howard Lilienthal. Ann. Surg., Phila., 1911, Aug. (2) 18, F. (3) ?. (4) 8 yrs. (5) Injury. (6) Bilateral. Bony. (7) Complete Closure. (8) ?. (9) ?. (10) Section of zygoma, removal of neck and condyle on left. Nine days later right similarly treated. (11) ?. (12) None. (13) Perfect in three weeks.

Case 31. (1) D. Hartwell. Ann. Surg., Phila., 1907, Jan. (2) 17, F. (3) April 1906. (4) 12 yrs. (5) Diphtheria. (6) Bony. Bilaterial. (7) Immobilized. (8) ?. (9) ⅜ inch. (10) Mass of bone attached to zygoma and ramus freed with chisel. (11) ?. (12) None. (13) Normal.

Case 32. (1) Rogers. St. Paul M. J., 1903, Sept. (2) 2 yrs. 9 mos., M. (3) ?. (4) 1½ yrs. (5) Pneumonia. (6) Left Bony. (7) Less than ⅛ inch. (8) Force under ether. (9) ?. (10) Section of neck, removal of zygoma and V-shaped piece bone. (11) ?. (12) None. (13) Full extent.

Case 33. (1) Dr. Ries. Illinois M. J., 1905, April. (2) 21, M. (3) Nov. 1904. (4) 1 mo. (5) Syphilis. (6) Bilateral. Cicatricial. (7) No movement. (8) Anti-syphilitic. (9) ?. (10) Left side—resected condyloid process dissected out coronoid process—inserted ivory peg. Right side—resection of condyloid. (11) ?. (12) None. (13) Mobility fair.

Case 34. (1) Mr. Cropper. Lancet, Lond., 1904, March 5. (2) 12., M. (3) Nov. 30, 1903. (4) 1 yr. (5) Ulcerative stomatitis. (6) Left cicatricial bands. (7) Clinched. (8) ?. (9) ?. (10) Gag inserted, bands divided with knife, cheek divided where it adhered to gums. (11) Open. (12) Foul mouth, healed. (13) Open 1 inch.

Case 35. (1) Mr. Fitzwilliams. Proc. Roy. Soc. Med., 1911–12. (2) F. (3) Nov. 12, 1911. (3) Dec. 25, 1911. (4) 7 yrs. (5) Rheumatism. (6) Bilaterial. Bony. (7) ⅜ inch. (8) ?. (9) ?. (10) Neck of left side divided —bone removed. (10) Ascending ramus on right removed. (11) ?. (12) None. (13) 19 mos. 2 inches.

Case 36. (1) Max Bauchwitz. Deutsche Monatschr. zahnh. (2) 40, F. (3) Sept. 1904. (4) 35 yrs. (5) Tooth extraction. (6) Left bony. (7) Slight. (8) ?. (9) Inferior maxilla not developed. (10) Removed angle and part of coronoid process. (11) ?. (12) None. (13) 1½ cm. opening.

Case 37. (1) M. Mauclaire. Bull. et mém. Soc. de Chir. de Par., 1910. (2) 25, F. (3) Feb. 1902. (4) 25 yrs. (5) Suppuration. (6) Bilateral. Bony. (7) None. (8) ?. (9) Retraction of chin. (10) Resection of condyle and coronoid process on both sides. (11) ?. (12) Facial Paralysis for 2 mos. (13) ¾ mm.

Case 38. (1) Nelaton. Bull. et mém. Soc. de Chir. de Par., 1910. (2) 12, M. (3) Feb. 23, 1910. (3) Mar. 15, 1910. (4) 3 yrs. (5) Fracture. (6) Bilateral. Bony. (7) None. (8) ?. (9) To right. (10) Section of zygoma — removal of bony mass on right muscle interposed. (10) Section of coronoid process and interpolation of muscle on left. (11) ?. (12) Difficult Anæsthesia. (13) Normal.

Case 39. (1) A. Demoulin. Bull. et Mém. Soc. de Chir. de Par., 1910. (2) 15, M. (3) Dec. 1909. (4) 1 yr. (5) Typhoid Fever. (6) Bilateral. Bony. (7) 1 cm. (8) ?. (9) Retreating chin. (10) Removed mass of bone, part of condyle and zygomatic process. Muscle interpolated. (11) ?. (12) None. (13) Open 2 cm.

Case 40. (1) Auguste Broca. Bull. méd., Par., 1910. (2) 11, F. (3) Summer 1909. (4) 7 yrs. (5) Injury. (6) Right Bony. (7) None. (8) ?. (9) Receding chin. (10) Resection of joint. (11) ?. (12) None. (13) Moderate success.

Case 41. (1) M. Donati. Gior. d. v. accad. di Méd. di Torino, 1910. (2) 9, M. (3) Dec. 1909. (4) 7 yrs. (5) Otitis Media. (6) Bilateral. Bony. (7) None. (8) ?. (9) Lower jaw receding. (10) Left resection of coronoid process. Four days later removed mass on the right 3 cm. thick (11) ?. (12) Grave cyanosis tracheotomy. (13) Good.

Case 42. (1) F. Kirsten. Med. Klin. Berl. 1908. (2) 18, M. (3) ?. (4) 14 yrs. (5) Injury. (6) Bilateral. Bony. (7) 1 cm. (8) ?. (9) Retreated chin. (10) Bony mass removed. Masseter muscle interposed on left. (11) ?. (12) Injured tympanum healed. Hearing normal. (13) 2 cm. opening.

Case 43. (1) V. Nausemann. Berl. Klin. Wchnschr., 1903. (2) M. (3) 1897. (4) All life. (5) Uncertain. Birth injury?. (6) Bilateral. Bony. (7) ?. (8) ?. (9). ?. (10) Resection of bone on right side. (11) ?. (12) None. (13) ?.

Case 44. (1) Carl Roser. Zentralbl. f. Chir., Leipzig, 1898. (2) 22, M. (3) Nov. 2, 1897. (4) 4 yrs. (5) Injury. (6) Bilateral. Cicatricial. (7) None. (8) ?. (9). ?. (10) Excised condyloid process. Gold plate interpolated. (11) Open. (12) None. (13) Open 1¾ cm.

Case 45. (1) Burch. Deutsche med. Wchnschr., 1907. (2) 45, F. (3) Nov. 1905 (4) 1 yr. (5) Mercurial stomatitis. (6) ?. (7) 5 mm. (8) ?. (9) ?. (10) Ulcer removed, resection of coronoid process, antrum of Highmore curetted defects covered with plastic flaps. (11) ?. (12) None. (13) 14 mos. later open 4 cm.

Case 46. (1) Korte. Deutsche med. Wchnschr., 1907. (2) ?. (3) 1890. (4) ?. (5) Measles. (6) Unilateral cicatricial. (7). ?. (8) ?. (9) ?. (10) Excision of cicatrix, defect covered with neck flap. (11) ?. (12) None. (13) Good.

Case 47. (1) Krause. Deutsche med. Wchnschr., 1907. (2) ?. (3) ?. (4) ?. (5) Gonorrhœa. (6) ?. (7) 2 mm. (8) ?. (9) ?. (10) Resection of joint, interpolation of masseter muscle. (11) ?. (12) None. (13) Good.

Case 48. (1) W. H. Bennett. (2) ?. (3) 1889. (4) ?. (5) ?. (6) Bilateral. Bony. (7) ?. (8) Double excision of condyles. (9) ?. (10) Double Esmarch operation. (11) ?. (12) None. (13) Permanent.

Case 49. (1) Little. N. Y. M. News, 1884, Dec. 20. (2) F. (3) 1863. (4) ?. (5) ?. (6) ?. (7) ?. (8) ?. (9) ?. (10) Excision of jaw. (11) ?. (12) None. (13) Good.

CASE 50. (1) Pitcher. N. Y. M. News, 1884, Dec. 20. (2) 4. (3) ?. (4) ?. (5) Salivation. (6) Unilateral cicatricial. (7) ?. (8) ?. (9) ?. (10) Excision of scar. Mucous membrane transplanted from lip. (11) ?. (12) None. (13) Fair.

CASE 51. (1) Lenox Curtis. J. Am. M. Ass., 1904, July 2. (2) 16, M. (3) ?. (4) 13½ yrs. (5) Fracture. (6) ?. (7) ?. (8) Stretching. (9) Shortening of lower jaw. (10) Refused. (11) ?. (12) None. (13) ?.

CASE 52. (1) Lenox Curtis. J. Am. M. Ass., 1904, July 2. (2) 14, M. (3) ?. (4) 8 yrs. (5) Diphtheria. (6) Right, fibrous. (7) ⅛ inch. (8) ?. (9) Lower jaw short. (10) Stretching. (11) ?. (12) None. (13) Fair.

CASE 53. (1) A. T. Cabot. Lancet, Lond., 1897, Aug. 7. (2) 13, F. (3) 1887. (4) 10 yrs. (5) Scarlet Fever. (6) Unilateral. (7) ?. (8) ?. (9) ?. (10) Condyle chiseled through. (11) ?. (12) Temporary paralysis of orb. palp. (13) ¾ inch opening.

CASE 54. (1) A. T. Cabot. Lancet, Lond., 1897, Aug. 7. (2) 17, F. (3) 1888. (4) 13 yrs. (5) Scarlet Fever. (6) Left Bony. (7) None. (8) ?. (9) ?. (10) Bone Section. (11) ?. (12) None. (13) ½ inch opening.

CASE 55. (1) A. T. Cabot. Lancet, Lond., 1897, Aug. 7. (2) 30, F. (3) 1889. (4) 27 yrs. (5) Injury. (6) Left Bony. (7) None. (8) Stretching. (9) ?. (10) Bone section. (11) ?. (12) Paralysis of 7th. (13) ¾ inch opening.

CASE 56. (1) A. T. Cabot Lancet, Lond., 1897, Aug. 7. (2) 32, F. (3) 1889. (4) 26 yrs. (5) Injury. (6) Right Bony. (7) None. (8) ?. (9) ?. (10) Bone Section. (11) ?. (12) None. (13) 5 yrs. later, 1 inch.

CASE 57. (1) A. T. Cabot, Lancet, Lond., 1897, Aug. 7. (2) 26, F. (3) 1890. (4) ?. (5) Injury. (6) Unilateral. (7) ?. (8) ?. (9) ?. (10) Bone Section. (11) ?. (12) Asphyxia-Laryngotomy. (13) Good.

CASE 58. (1) A. T. Cabot. Lancet, Lond., 1897, Aug. 7. (2) 8, M. (3) 1890. (4) 6 yrs. (5) Scarlet Fever. (6) Single Bony. (7) None. (8) ?. (9) ?. (10) Bone section. (11) ?. (12) None. (13) Normal

CASE 59. (1) A. T. Cabot. Lancet, Lond., 1897, Aug. 7. (2) 37, F. (3) 1891. (4) 30 yrs. (5) Injury. (6) Right Bony. (7) None. (8) Stretching. (9) ?. (10) Bone section (11) ?. (12) Slight twitching of eye. (13) Open 1 inch.

CASE 60. (1) Allingham. Brit. M. J., 1886, Dec. 1. (2) 7, M. (3) ?. (4) Mos. (5) Injury. (6) ?. (7) Slight. (8) ?. (9) ?. (10) Removed condyle. (11) ?. (12) None. (13) ?.

CASE 61. (1) David Greig. Practitioner, 1889. (2) 12, M. (3) ?. (4) 5 yrs. (5) Scarlet Fever. (6) Fibrous. (7) ?. (8) ?. (9) ?. (10) Removed condyle. (11) ?. (12) None. (13) ½ inch opening.

CASE 62. (1) David Greig. Practitioner, 1889. (2) 28, M. (3) ?. (4) 4 yrs. (5) Scarlet Fever. (6) ?. (7) ?. (8) ?. (9) ?. (10) Excision of condyle? (11) ?. (12) Permanent Facial Paresis. (13) ?.

CASE 63. (1) David Greig. Practitioner, 1889. (2) 10, F. (3) ?. (4) 3½ yrs. (5) Typhoid Fever. (6) Fibrous. (7) ?. (8) Operations. (9) ?. (10) Excision of coronoid process. (11) ?. (12) None. (13) ½ inch opening.

CASE 64. (1) David Greig. Practitioner, 1889. (2) 12, M. (3) ?. (4) 7 yrs. (5) Injury. (6) Fibrous. (7) ?. (8) ?. (9) ?. (10) Excision of coronoid process. (11) ?. (12) None. (13) Good.

CASE 65. David Greig. Practitioner, 1889. (2) 30, F. (3) ?. (4) 27 yrs. (5) Injury. (6) ?. (7) ?. (8) Operation at 20 yrs. (9) ? (10) Excision of condyle. (11) ?. (12) None. (13) Good.

CASE 66. (1) Goodwillie. N. Y. M. J., 1875, July. (2) 10, F. (3) 1875. (4) 5 yrs. (5) Injury. (6) Fibrous. (7) ?. (8) Force applied. (9) Retreating jaw. (10) Continuous forced dilatation. (11) ?. (12) None. (13) ⅜ inch opening.

CASE 67. (1) Goodwillie. N. York M. J., 1875, July. (2) 21, F. (3) 1872. (4) ?. (5) Tonsilitis. (6) Fibrous. (7) ?. (8) ?. (9) ?. (10) Continuous dilatation for 6 mos. (11) ?. (12) None. (13) 1 inch opening.

CASE 68. (1) Bruce. Canad. Lancet, 1898, May. (2) F. (3) 1897. (3) Nov. 1897. (4) 2½ yrs. (5) Fracture. (6) Right Bony. (7) ?. (8) Gag. (9) Displaced to right. (10) Section of neck of condyle (abandoned). (10) Removed coronoid process, portion of ascending ramus. (11) ?. (12) Profound narcosis. (12) Paralysis of orb. palp. (13) None. (13) ⅜ inch opening.

CASE 69. (1) Morton. Canad. Lancet, 1897, Sept. (2) 57, M. (3) Oct. 1896. (4) 4 yrs. (5) Arthritis. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Division of both necks. (11) ?. (12) Paralysis of orb. palp. (13) ⅜ inch opening, good mastication.

CASE 70. (1) Helferich. Arch. f. Klin. Chir., 1894. (2) 13, M. (3) 1893. (4) 7 yrs. (5) Injury. (6) ?. (7) None. (8) ?. (9) Retracted jaw. (10) Resection of the joint. (11) ?. (12) None. (13) Recurrence.

CASE 71. (1) Helferich. Arch. f. Klin. Chir., 1894. (2) Child. F. (3) June 29, 1893. (4) ?. (5) ?. (6) Left bony. (7) Slight on right. (8) ?. (9) No chin. (10) Resection of condyloid process, interpolation of muscle. (11) ?. (12) None. (13) Open 2½ cm.

CASE 72. (1) Hedrich. Gaz. Med. de Strasb., 1891. (2) 11, M. (3) Oct. 15, 1890. (4) 6 yrs. (5) Injury. (6) Bilateral. Bony. (7) None. (8) ?. (9) Retreating chin (10) Bone resection. (11) ?. (12) Fistula cured. (13) Open 3 cm.

CASE 73. (1) Hagedorn. Verhandl. d. Deutsche Gesellsch. f. Chir., 1880. (2) 36, F. (3) ?. (4) 6 yrs. (5) Rheumatism. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Resection of condyloid process. (11) ?. (12) None. (13) Open 2 cm.

CASE 74. (1) Samuel D. Gross. System of Surgery, 1882. (2) 7, F. (3) 1884. (4) ?. (5) Rheumatism (6) Left Bony. (7) ?. (8) ?. (9) ?. (10) Excision of condyle. (11) ?. (12) None. (13) Good movement.

CASE 75. (1) Gardiner. Austral. M. J., 1893. (2) 10, M. (3) Dec. 21, 1892. (4) 9 yrs. (5) Abscesses. (6) Bilateral. Bony. (7) ¼ inch. (8) Condyles removed. (9) ?. (10) Excision of part of ramus. (11) ?. (12) None. (13) ¾ inch opening.

CASE 76. (1) Capony. Thèse de Lyon, 1892. (2) 25, M. (3) . (4) 10 yrs. (5) Injury. (6) Bilateral. Bony. (7) ?. (8) ?. (9) Retreating chin. (10) Resection of both joints. (11) ?. (12) Permanent right facial paresis. (13) Normal.

CASE 77. (1) S. G. Campbell. Glasgow M. J., 1889. (2) 28. (3) ?. (4) 22 yrs. (5) Fracture. (6) Right Bony. (7) None on right. (8) ?. (9) Imperfect development. (10) Bone resection. (11) ?. (12) None. (13) ?.

CASE 78. (1) R. Borella. Jahr. d. Med., 1892. (2) 24, F. (3) ?. (4) 19 yrs. (5) Injury. (6) Bilateral. Bony. (7) ?. (8) ?. (9) Typical. (10) Resection of condyles. (11) ?. (12) None. (13) Recurred in 10 mos.

CASE 79. (1) Bornet. Gaz. de Hop., 1863. (2) 14, F. (3) June 20, 1863. (4) ?. (5) Gangrenous stomatitis. (6) Right Bony. (7) ?. (8) Dilatation and Rizzoli's operation. (9) ?. (10) Esmarch's operation. (11) ?. (12) None. (13) Opening 1 cm.

CASE 80. (1) E. N. Nason. Lancet, Lond., 1895. (2) 39, M. (3) Jan. 7, 1894. (4) 7 yrs. (5) Injury. (6) Right Bony. (7) None. (8) ?. (9) ?. (10) Removed wedge of bone. (11) ?. (12) None. (13) Permanent.

CASE 81. (1) Middledorpf and Fischer. Arch. f. klin. Chir., 1871. (2) 27, M. (3) July 2, 1868. (3) Nov. 25, 1868. (4) ?. (5) Scarlet Fever. (6) Bilateral. Bony. (7) Slight. (8) ?. (9) Retreating chin. (10) Excision of bone wedge by Esmarch's method. (11) ?. (12) None. (13) 3.2 cm. open.

CASE 82. (1) J. Wolf. Verhandl. der Berl. med. Gesellsch., 1897. (2) 17, M. (3) Mar. 6, 1897. (4) 16 yrs. (5) Forceps delivery. (6) Bilateral. Bony. (7) None. (8) ?. (9) Birds Beak. (10) Coronoid process separated from temporal insertion. Small piece removed. (11) ?. (12) None. (13) Open 3 cm.

CASE 83. (1) Whitehead. Brit. M. J., 1874. (2) 10, F. (3) ?. (4) 6 yrs. (5) Scarlet Fever. (6) Bilateral. Bony. (7) None. (8) Force with anæsthetic. (9) ?. (10) Forcible fracture of condyle. (11) ?. (12) None. (13) Almost normal.

CASE 84. (1) Paul Ischmarke. Med. Gesellschaft zu Magdeburg, 1898. (2) 11, F. (3) July 11, 1898. (4) 9 yrs. (5) Injury. (6) Unilateral. Bony. (7) None. (8) ?. (9) Birds beak. (10) Removed condyloid process, head and neck. (11) ?. (12) None. (13) Good.

CASE 85. (1) Schulten. Arch. gén. de. Chir., Par., 1879. (2) 13, M. (3) 1877. (4) 10 yrs. (5) Otorrhœa. (6) Bilateral. Bony. (7) ?. (8) Both coronoid processes cut through. (9) ?. (10) Section of coronoid process. (11) ?. (12) None. (13) Successful.

CASE 86. (1) Riegner. Deutsche med. Wchnschr., 1896. (2) ?. (3) ?. (4) ?. (5) ?. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Helferich's operation. (11) ?. (12) None. (13) Excellent.

CASE 87. (1) Poulton. 1893. Austral. M. Gaz. (2) 17, F. (3) 1892. (4) 11 yrs. (5) Injury. (6) Bilateral. Bony. (7) $\frac{1}{16}$ inch. (8) ?. (9) ?. (10) Removed neck and part of condyle. (11) ?. (12) Sinus on left. (13) Good movement.

CASE 88. (1) Poulton. 1893. Austral. M. Gaz. (2) 24, F. (3) 1892. (4) ?. (5) Fever. (6) Right Bony. (7) ?. (8) ?. (9) ?. (10) Removed neck of condyle and base of zygoma. (11) ?. (12) None. (13) Free movement.

CASE 89. (1) Rhinault. Lancet, Lond., 1883. (2) 3¾, M. (3) April 30, 1882. (4) 2 yrs. (5) Injury. (6) Left Bony. (7) ?. (8) ?. (9) ?. (10) Removed fragments from zygoma. (11) ?. (12) None. (13) Open 1 inch.

CASE 90. Reid. Arch. gén. de Méd., 1879. (2) ?. (3) Aug. 22, 1857. (4) ?. (5) ?. (6) Cicatricial. (7) ?. (8) ?. (9) ?. (10) Resected piece of mandible. (11) ?. (12) None. (13) Good.

CASE 91. (1) Roosing. Zentralbl. f. Chir., 1893. (2) 31, F. (3) Oct. 19. 1889. (4) 1 yr. (5) Pyæmia. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Bottini-Konig's method. (11) ?. (12) None. (13) Normal.

CASE 92. (1) Roosing. Zentralbl. Chir., 1893. (2) ?. (3) Apr. 17, 1890. (4) 1 yr. (5) Rheumatism. (6) Right Bony. (7) 1 mm. (8) ?. (9) ?. (10) Bottini-Konig's method. (11) ?. (12) None. (13) ?.

CASE 93. (1) Little. 1873-4 Tr. N. York M. Soc. (2) 19, F. (3) Sept. 20, 1873. (4) 5 yrs. (5) Abscess. (6) Right Bony. (7) None. (8) ?. (9) ?. (10) Excision of condyle. (11) ?. (12) None. (13) Open ⅞ inch.

CASE 94. (1) Maas. 1871-72. Arch. f. Klin. Chir. (2) 27, M. (3) July 2, 1868. (3) Nov. 25, 1868. (4) 17 yrs. (5) Scarlet Fever. (6) Bilateral. Bony. (7) None. (8) ?. (9) Retreating chin. (10) Esmarch's operation on right. (10) Esmarch's operation on left. (11) ?. (12) None. (13) Open 3.2 cm.

CASE 95. (1) W. Grube. 1863. Arch. f. Klin. Chir. (2) 21, F. (3) Sept. 23, 1861. (3) Oct. 25, 1861. (4) 15 yrs. (5) Swelling. (6) Left Bony. (7) None. (8) ?. (9) Retreating jaw. (10) Excision of joint and condyloid process removed through mouth. (10) Subcutaneous section of masseter. (11) ?. (12) None. (13) Muscle contracted. (13) Good movement.

CASE 96. (1) R. Abbe. 1881. N. York M. J. (2) 10, M. (3) Dec. 10, 1879. (4) 7 yrs. (5) Otitis Media. (6) Left Bony. (7) Slight. (8) Dilatations. (9) Retreating chin. (10) Removed neck of mandible. (11) ?. (12) None. (13) Good.

CASE 97. (1) Ranke. 1885. Arch. f. klin. Chir. (2) 10, M. (3) Mar. 9, 1885. (4) 9 yrs. (5) Suppuration. (6) Left Bony. (7) ?. (8) ?. (9) ?. (10) Konig's Resection. (11) ?. (12) None. (13) Open 3.5 cm.

CASE 98. (1) H. Morestin. 1910. Bull. et mém. Soc. de Chir. de Par. (2) 18, F. (3) Jan. 2, 1900. (3) Jan. 16, 1900. (4) 14 yrs. (5) Injury. (6) Bilateral. Bony. (7) None. (8) ?. (9) Chin retracted. (10) Bony mass removed on right. (10) Bony mass removed on left. (11) ?. (12) Occasional subluxation. (13) Open 3 cm.

CASE 99. (1) M. Ceravasse. Bull. et mém. Soc. de Chir. de Par., 1896. (2) 30, M. (3) Dec. 26, 1893. (4) 6 yrs. (5) Gunshot. (6) Right Bony. Left Fibrous. (7) None (8) ?. (9) ?. (10) Resection of bone on right. Adhesions broken on left. (11) ?. (12) Chloroform narcosis. Laryngotomy. (13) Good.

CASE 100. (1) Felix Legueu. Bull. et mém. Soc. de Chir. de Par., 1903. (2) M. (3) Oct., 1901. (4) 13 yrs. (5) Injury. (6) Bony. (7) None. (8) ?. (9) Jaws in contact. (10) Removed part of condyle. (11) ?. (12) Paralysis of orbic palp., recovery. (13) Excellent.

CASE 101. (1) Nicola Giannetasis. Gaz. d. osp. Milano. 1907. (2) 20, M. (3) Apr. 20, 1907. (4) 8 yrs. (5) Typhoid. (6) Right Bony. (7) None. (8) ?. (9) ?. (10) Removed callus. (11) ?. (12) Slight paresis. (13) Good.

CASE 102. (1) Mario Donati. Arch. gén. de Chir. de Par., 1912. (2) 9, M. (3) Dec. 9, 1900. (3) Dec. 13, 1900. (4) 7 yrs. (5) Suppurative otitis. (6) Bilateral. Bony. (7) None. (8) ?. (9) Retreating chin. (10) Resection of right condyle. (10) Removed bony mass from left. (11) ?. (12) Tracheotomy. (13) Perfect 2 yrs. later.

CASE 103. (1) Alexander. Beitr. f. klin. Chir., 1898. Tubing. (2) 15, F. (3) May 7, 1895. (4) 13 yrs. (5) Fever. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Resection of both sides. (11) ?. (12) None. (13) Open 2 to 3 cm.

CASE 104. (1) Alexander. Beitr. f. klin. Chir. Tubing, 1898. (2) 17, F. (3) June 20, 1895. (4) 16 yrs. (5) Scarlet Fever. (6) Right Bony. (7) None. (8) ?. (9) ?. (10) Bone removed. Muscle interposed. (11) ?. (12) None. (13) Open 2 cm.

CASE 105. (1) Alexander. Beitr. f. klin. Chir. Tubing. 1898. (2) 12, M. (3) Aug. 14, 1897. (4) 4 yrs. (5) Rheumatism. (6) Left Bony. (7) None. (8) ? (9) ?. (10) Bone removed from joint, coronoid process removed. Muscle interposed. (11) ?. (12) None. (13) Normal.

CASE 106. (1) Giors, Phila. Injuries and diseases of the jaw by Heath. (2) 7, F. (3) 1874. (4) ?. (5) ?. (6) ?. (7) ?. (8) ?. (9) ?. (10) Resection of condyle. (11) ?. (12) None. (13) ?.

CASE 107. (1) Wilrus. Berlin. Arch. f. klin. Chir., 1871. (2) ?. (3) 1858. (4) ?. (5) ?. (6) Cicatricial. (7) ?. (8) ?. (9) ?. (10) Esmarch operation. (11) ?. (12) None. (13) Good.

CASE 108. (1) Dittl. Vienna. Arch. gén. d. med., 1860. (2) 20, M. (3) June 16, 1859. (4) 10 yrs. (5) Injury. (6) Right Bony. (7) ?. (8) Gymnastics. (9) Retreating chin. (10) Esmarch. (11) ?. (12) None. (13) Good.

CASE 109. (1) Wagner. Königsberg. Injuries and Diseases of the Jaw, Heath. (2) ?. (3) ?. (4) ?. (5) ?. (6) ?. (7) ?. (8) ?. (9) ?. (10) Esmarch operation. (11) ?. (12). None. (13) Good.

CASE 110. (1) L. Bilczynaki. Jahresbt. d. Med., 1897. (2) 13, F. (3) ?. (4) 7 yrs. (5) Variola. (6) Left Bony. (7) None. (8) ?. (9) Retreating chin. (10) Resection of 2 cm. bone interposition of muscle. (11) ?. (12) None. (13) 3 cm. opening.

CASE 111. (1) E. Von Bergemann. Arch. f. klin. Chir., 1892–1893. (2) 19, F. (3) Oct. 10, 1891. (4) 19 yrs. (5) Forceps delivery. (6) Bilateral. Bony. (7) None. (8) ?. (9) Retracted chin. (10) Resection of both processes. (11) ?. (12) None. (13) Open 3 cm.

CASE 112. (1) Aubry. Schmidt's Jahrb., 1865. (2) 13, M. (3) June 8, 1863. (4) 3 yrs. (5) Gangrene of mouth (6) Left Bony. (7) Slight. (8) ?. (9) ?. (10) Excision of horizontal ramus. (11) ?. (12) None. (13) Normal.

CASE 113. (1) Aubry. Schmidt's Jahrb., 1865. (2) 26, F. (3) Jan. 29, 1864. (4) ?. (5) Gangrene of mouth. (6) Left Bony. (7) ?. (8) ?. (9) ?. (10) Excision of horizontal ramus. (11) ?. (12) None. (13) Normal.

CASE 114. (1) Valaguier. Bull. et mém. Soc. de Chir. de Par., 1892. (2) 9, F. (3) Sept. 15, 1892. (4) 5 yrs. (5) Injury. (6) Left Bony. (7) None. (8) ?. (9) Displaced forward. (10) Resection of ramus. (11) ?. (12) None. (13) Normal.

CASE 115. (1) Hoffa. Zentralbl. f. Chir., 1891. (2) 24, M. (3) ?. (4) ?. (5) Abscesses. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Resection of coronoid processes. (11) ?. (12) ?. 13) Good.

CASE 116. (1) Krummer. Bull. et mém. Soc. de Chir., Paris, 1892. (2) 14, F. (3) Mar. 17, 1891. (4) 3½ yrs. (5) Injury. (6) Bilateral. Bony. (7) None. (8) ?. (9) ? (10) Resection of both condyles. (11) ?. (12) None. (13) Good mastication.

CASE 117. (1) Konig. Deutshe Ztschr. f. Chir., 1878. (2) 11, F. (3) Nov. 29, 1876. (4) 9 mos. (5) Tooth infection. (6) Left Bony. (7) ½ cm. (8) ?. (9) ? (10) Resection of joint. (11) ?. (12) Fistula. (13) Good.

CASE 118. (1) Konig. Deutshe Ztschr. f. Chir., 1878. (2) 27, F. (3) Oct. 13, 1877. (4) 6 yrs. (5) Typhoid. (6) Right Bony. (7) 1 cm. on left. (8) ?. (9) ?. (10) Resection of joint. (11) ?. (12) None. (13) Normal.

CASE 119. (1) Karenski. Berl. klin. Wchnschr., 1899. (2) 24, F. (3) Sept. 1, 1898. (4) 14 yrs. (5) Febrile Disease. (6) Right Bony. (7) None. (8) Excision of scars. Dilatation. (9) Bird's beak. (10) Removal of piece of bone. (11) ?. (12) None. (13) Expression good. Open 3 cm.

CASE 120. (1) P. Jernoli. Zentralbt. f. Chir., 1891. (2) 17, F. (3) ?. (4) 16½ yrs. (5) Pertuasis. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Bottini resected both coronoid processes. (11) ?. (12) None. (13) Marked improvement.

CASE 121. (1) E. Küster. Langenbeck's Arch., 1888. (2) 18, F. (3) July 14, 1885. (4) 10 yrs. (5) Scarlet Fever. (6) Left Bony. (7) Slight. (8) ?. (9) Birds beak. (10) Resection of bone. (11) ?. (12) None. (13) Opening 3 cm.

CASE 122. (1) E. Küster. Langenbeck's Arch., 1888. (2) 14, M. (3) Apr. 18, 1887. (4) 2 yrs. (5) Boil. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Resection of joint. (11) ?. (12) Tracheotomy. (13) Recurrence.

CASE 123. (1) E. Küster. Langenbeck's Arch., 1888. (2) 9, M. (3) Oct. 10, 1887. (4) 6 yrs. (5) Diphtheria. (6) Bilateral. Bony. (7) Slight. (8) ?. (9) ?. (10) Resection of both joints and left coronoid process. (11) ?. (12) None. (13) Satisfactory.

CASE 124. (1) E. Küster. Langenbeck's Arch., 1888. (2) 12, M. (3) Mar. 27, 1888. (4) 6 yrs. (5) Diphtheria. (6) Bilateral. Bony. (7) None. (8) Konig's operation. (9) ?. (10) Not described. (11) ?. (12) None. (13) Normal.

CASE 125. (1) Kulenkampff. Zentr. f. Chir., 1885. (2) 11, M. (3) ?. (4) 6 yrs. (5) Periostitis. (6) Left Bony. (7) 5 mm. (8) ?. (9) Displaced to left. (10) Excision of end of ramus. (11) ?. (12) Facial paresis. (13) Open 3.2 cm.

CASE 126. (1) A. Lucke. Arch. f. klin. Chir., 1862. (2) 8, M. (3) ?. (4) ?. (5) Noma. (6) Left Bony. (7) ?. (8) Plastic operation. (9) ?. (10) Esmarch's operation. (11) ?. (12) Fistula. (13) 1½ yrs. later open, normal.

CASE 127. (1) A. Lucke. Arch. f. klin. Chir., 1862. (2) 4, M. (3) ?. (4) ?. (5) ?. (6) Left Bony. (7) ?. (8) ?. (9) ?. (10) Section of bone (Rizzolis'). (11) ?. (12) Fistula. (13) Opening 1 cm.

CASE 128. (1) A. Lucke. Arch. f. klin. Chir., 1862. (2) 19, M. (3) June 1861. (4) 6 yrs. (5) Typhoid?. (6) Left Bony. (7) ?. (8) Plastic operations. (9) ?. (10) Section of bone at second molar. (11) ?. (12) None. (13) Died of pyemia.

CASE 129. (1) Haus. Deutsche Ztschr. f. Chir., 1900. (2) 17, F. (3) Nov. 3, 1897. (4) 2 yrs. (5) Osteomyelitis. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Bone chiseled out. (11) ?. (12) None. (13) Recurrence.

CASE 130. (1) Haus. Deutsche Ztschr. f. Chir., 1900. (2) 8, M. (3) June 10, 1899. (4) 3 yrs. (5) Scarlet Fever. (6) Bilateral. Bony. (7) ?. (8) Dilatations. (9) Displaced to right. (10) Removal of piece of bone. (11) ?. (12) None. (13) ?.

CASE 131. (1) Wagner. 1861. Schmidt's Jahrbr. (2) ?. (3) 1859. (4) ?. (5) Gangrene. (6) Unilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Excision of bone wedge. (11) ?. (12) None. (13) Good.

CASE 132. (1) Lentz. Cong. franc. de Chir., Procesberbaux, 1895. (2) 14, M. (3) Dec. 18, 1894. (4) 8 yrs. (5) Scarlatina. (6) Unilateral. Bony. (7) None. (8) ?. (9) ?. (10) Resection of condyle. Interposition of muscle. (11) ?. (12) Paresis of upper eye lid. (13) Open 3½ cm.

CASE 133. (1) Langenbeck. Langenbeck's Arch. (2) 17, M. (3) June 16, 1860. (4) 17 yrs. (5) Congenital. (6) Bilateral. Bony. (7) None. (8) Section of masseters. (9) Retracted Chin. (10) Resection of both coronoids. (11) ?. (12) None. (13) Good.

CASE 134. (1) Lange. Jahresb. d. med., 1886. (2) 8, F. (3) ?. (4) 3 yrs. (5) ?. (6) Left Bony. (7) Slight. (8) ?. (9) ?. (10) Resection of left joint (Konig). (11) ?. (12) None. (13) Good function.

CASE 135. (1) J. E. Mears. Tr. Am. Surg. Ass., 1881. (2) 20, F. (3) Jan. 26, 1883. (4) 18 yrs. (5) Gunshot wound. (6) Left Bony. (7) ?. (8) ?. (9) ?. (10) Excision of condyle. Resection of masseter muscle. (11) ?. (12) None. (13) Good.

CASE 136. (1) H. McGuire. Tr. Am. Surg. Ass., 1881. (2) Child. (3) ?. (4) ?. (5) Callus. (6) ?. (7) ?. (8) ?. (9) ?. (10) Wedge of bone removed at joint. (11) ?. (12) None. (13) Recurrence.

CASE 137. (1) H. McGuire. Tr. Am. Surg. Ass., 1881. (2) F. (3) 1875. (4) ?. (5) ?. (6) Cicatricial bands. (7) ?. (8) ?. (9) ?. (10) Cut through bands and removed osseous plates. (11) ?. (12) None. (13) Good.

CASE 138. (1) W. Knight. (2) 18, F. (3) Oct. 1892. (4) 13 yrs. (5) Injury. (6) Bilateral. Bony. (7) None. (8) Dilatation. (9) Receding chin. (10) Removal of

wedge shape bone. (11) ?. (12) None. (13) Can chew solids.

Case 139. (1) A. J. McCosh. Ann. Surg., Phila., 1893. (2) 26, F. (3) Jan. 1893. (4) 3½ yrs. (5) Sepsis?. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Bone resection. (11) ?. (12) None. (13) Can open mouth wide.

Case 140. (1) McBierney. Ann. Surg., Phila., 1893. (2) ?. (3) ?. (4) 12–14 yrs. (5) Tubercular? (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Removed coronoid processes with head and neck of lower jaw. (11) ?. (12) None. (13) Open 1½ cm.

Case 141. (1) J. R. Lunn. Tr. Clin. Soc., Lond., 1896. (2) 45, M. (3) Aug. 18, 1894. (4) 23 yrs. (5) Rheumatism. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Division of necks of condyles, piece of bone removed. (11) ?. (12) None. (13) Successful.

Case 142. (1) L. Poisson. Rev. de Chir., 1891. (2) 23, F. (3) Apr. 2, 1891. (4) 20 yrs. (5) ?. (6) Bilateral. Bony. (7) None. (8) ?. (9) Retreating chin. (10) Section angles of jaw, wedge removed from right. (11) ?. (12) None. (13) Opening 2 cm.

Case 143. (1) L. Ollier. Traite des Resections, Paris, 1891. (2) 16, F. (3) Oct. 1890. (4) 8 yrs. (5) Scarlet Fever. (6) Left. (7) 3 mm. (8) ?. (9) ?. (10) Resection of condyle and neck. (11) ?. (12) Temporary Facial paresis. (13) Open 3 cm.

Case 144. (1) Rizzoli. Bologna. (2) 15, M. (3) 1857. (4) 5 yrs. (5) Tuberculosis. (6) Right Bony. (7) None. (8) ?. (9) ?. (10) Bone section from within the mouth, (4 cases similarly treated). (11) ?. (12) None. (13) Good.

Case 145. (1) W. T. Bull. 1885. N. York M. News. (2) 14, M. (3) ?. (4) 4 yrs. (5) Otitis Media. (6) Right Fibrous. (7) ?. (8) Rupture of adhesions. (9) ?. (10) Excision of condyle. (11) ?. (12) None. (13) Free opening.

Case 146. (1) Weir. Dec. 20, 1884. N. York M. News. (2) 32, F. (3) May 1879. (3) 1883. (4) ?. (5) Injury. (6) Cicatricial. (7) ?. (8) ?. (9) ?. (10) Scars excised. (10) Excision of body of ramus. (11) ?. (12) Much pain. (13) Normal.

Case 147. (1) Weir. Dec. 20, 1884. N. York M. News. (2) 16, M. (3) 1882. (4) 9 yrs. (5) Injury. (6) Bony?. (7) None. (8) Stretching. (9) ?. (10) Piece of bone removed. (11) ?. (12) None. (13) Good motion.

Case 148. (1) Esmarch. 1860. Arch. gén de Med. (2) 16, M. (3) May 4, 1858. (4) 1 yr. (5) Typhoid fever and gangrene. (6) Left Bony. (7) Slight. (8) ?. (9) ?. (10) Resection of bone at 4th molar. Plastic lip operation. (11) ?. (12) None. (13) Good function.

Case 149. (1) Wilms. Reported by Esmarch. (2) 8, F. (3) Mar. 30, 1858. (4) 3 yrs. (5) Ulcer of mouth. (6) Right Cicatricial. (7) ?. (8) Passive motion, wedge and incision of scars. (9) ?. (10) Esmarch operation. (11) ?. (12) None. (13) Open 2 cm.

Case 150. (1) Ranke. 1885. Arch. f. klin. Chir. (2) 25, M. (3) ?. (4) 13 yrs. (5) Fracture. (6) Right Bony. (7) 1 mm. (8) ?. (9) ?. (10) Konig's resection. (11) ?. (12) None. (13) Permanent.

Case 151. (1) Ranke. 1885. Arch. f. klin. Chir. (2) 16, F. (3) ?. (4) Early youth. (5) Osteomyelitis. (6) ?. (7) ?. (8) ?. (9) Retreating Chin. (10) König's operation. (11) ?. (12) None. (13) Improvement.

Case 152. (1) Ranke. 1885. Arch. f. klin. Chir. (2) 17, M. (3) ?. (4) 10 yrs. (5) Injury. (6) Bilateral. Bony. (7) None. (8) ?. (9) ?. (10) Bilateral resection by Bottini. (11) ?. (12) None. (13) Excellent.

Case 153. (1) Nagel. Diss Gottengen., 1878. (2) 17, F. (3) ?. (4) ?. (5) Noma. (6) Cicatricial. (7) ?. (8) Removal of scar. (9) ?. (10) Bone section. Mucous membrane interposed. (11) ?. (12) None. (13) Normal

Case 154. (1) Baum. Cited by Bruncke. Diss., Gottengen, 1878. (2) 18, M. (3) ?. (4) 13 yrs. (5) Fracture. (6) Bony. (7) Slight. (8) ?. (9) ?. (10) Esmarch's operation. (11) ?. (12) None. (13) Good.

Case 155. (1) Buck. Cited by Bruncke. Diss., Gottengen, 1878. (2) ?. (3) ?. (4) ?. (5) Noma. (6) ?. (7) ?. (8) Plastic operations. (9) ?. (10) Esmarch's operation. (11) ?. (12) None. (13) Satisfactory.

Case 156. (1) Demarquay. Cited by Bruncke. Diss., Gottengen, 1878. (2) 16, F. (3) 1869. (4) 14½ yrs. (5) Typhoid. (6) Cicatricial. (7) ?. (8) Rizzoli's oper. (9) ?. (10) Esmarch's operation. (11) ?. (12) None. (13) Death.

Case 157. (1) Durham. Cited by Bruncke. Diss., Gottengen, 1878. (2) 37, M. (3) 1871. (4) ?. (5) Gangrene. (6) ?. (7) ?. (8) Operation. (9) ?. (10) Esmarch's operation. (11) ?. (12) None. (13) Satisfactory.

Case 158. (1) Esterle. Cited by Bruncke. Diss., Gottengen, 1878. (2) 24, F. (3) ?. (4) ?. (5) Gangrene. (6) ?. (7) ?. (8) ?. (9) ?. (10) Section of bone in front of ankylosis. (11) ?. (12) None. (13) Normal.

Case 159. (1) Herrgott. Cited by Bruncke, Diss., Gottengen, 1878. (2) ?. (3) ?. (4) ?. (5) Necrosis. (6) ?. (7) ?. (8) ?. (9) ?. (10) Bone section. (11) ?. (12) None. (13) Good.

Case 160. (1) Bruns. Cited by Verneuil. Arch. gén. de méd. 1860. (2) 5½, M. (3) Mar. 1855. (4) 2 yrs. (5) Gangrene. (6) Left Cicatricial. (7) None. (8) Dilatation. (9) ?. (10) Wedge of bone removed. (11) ?. (12) None. (13) Recurrence.

Case 161. (1) Carnochan. Cited by Verneuil. Arch. gén. de méd. (2) 13, F. (3) 1840. (4) ?. (5) ?. (6) ?. (7) ?. (8) ?. (9) ?. (10) Attempt made to force opening, jaw fractured. (11) ?. (12) None. (13) Recurrence.

Case 162. (1) Marjolin. Gaz. Hebd. d. méd. d. Chir. 1863. (2) 7, F. (3) 1862. (4) ?. (5) Gangrene. (6) Left Cicatricial. (7) Slight. (8) Dilatation. (9) ?. (10) Section of bone at cicatrix. (11) ?. (12) Gangrene. (13) Partial recurrence.

Case 163. (1) Huguier. Gaz. Hebd. d. méd. d. Chir. 1863. (2) Child. (3) May 1860. (4) ?. (5) ?. (6) Unilateral cicatricial. (7) ?. (8) ?. (9) ?. (10) Simple section. (11) ?. (12) None. (13) Recurrence.

Case 164. (1) Bauchet. Gaz. Hebd. d. med. d. Chir. 1863. (2) ?. (3) Sept. 1862. (4) ?. (5) ?. (6) Left cicatricial. (7) ?. (8) ?. (9) ?. (10) Resection of bone in front. (11) ?. (12) None. (13) Good at first. Recurrence.

Case 165. (1) Deguise. Gaz. Hebd. d. méd. d. Chir. 1863. (2) 7, F. (3) Apr. 1862. (4) ?. (5) Typhoid. (6) Unilateral. (7) ?. (8) ?. (9) ?. (10) Removal of 1½ cm. of bone. (11) ?. (12) None. (13) Recurrence.

Case 166. (1) Rossander. Arch. gén. d. méd. 1879. (2) 7, F. (3) Jan. 1877. (4) 2 yrs. (5) Scarlatina. (6) Left Bony. (7) None. (8) ?. (9) ?. (10) Section of neck of condyle. (11) ?. (12) None. (13) Permanent.

Case 167. (1) Orlow. 1902–3. D. Ztschr. f. Chir., Leipz. (2) 21, M. (3) Dec. 1899. (4) 14 yrs.? (5) Scarlet Fever?. (6) Left Bony. (7) ½ mm. (8) ?. (9) Chin retracted. (10) Removed ¼ of ascending ramus. (11) ?. (12) None. (13) ¾ cm.

Case 168. (1) Orlow. D. Ztschr. f. Chir., Leipz., 1902–3. (2) 28, M. (3) Feb. 4, 1900. (4) 24 yrs.? (5) Abscesses. (6) Right Bony. (7) 1 mm. (8) ?. (9) Displaced to right. (10) Bone section. (11) ?. (12) Facial paresis. (13) Fair.

CASE 169. (1) Orlow. D. Ztschr. f. Chir., Leipz., 1902. (2) 19, M. (3) Nov. 27, 1900. (4) 8 yrs. (5) Gangrene. (6) Left Bony. (7) 1 cm. (8) ?. (9) Displaced to left. (10) Removed 1½ cm. of bone. Inserted aluminum plate. (11) ?. (12) Facial paresis, recovery. (13) Opening 2¼ cm.

CASE 170. (1) Orlow. D. Ztschr. f. Chir., Leipz., 1902–3. (2) 23, M. (3) Dec. 5, 1900. (4) 20 yrs. (5) Injury. (6) Bilateral. Bony. (7) 2–3 cm. (8) ?. (9) Displaced to right. (10) Removed piece of bone. (11) ?. (12) Facial paresis. (13) Opening 3 cm.

CASE 171. (1) Orlow. D. Ztschr. f. Chir., Leipz., 1902–3. (2) 20, M. (3) Oct. 19, 1901. (4) 13 yrs. (5) Variola. (6) Left Bony. (7) ¾ cm. (8) ?. (9) Displaced to left. (10) Bone resected. Gold plate implanted. (11) ?. (12) Facial paresis. (13) Fair.

CASE 172. (1) Orlow. D. Ztschr. f. Chir., Leipz., 1902–3. (2) 5, M. (3) Nov. 12, 1901. (4) 2 yrs. (5) Injury. (6) Left Bony. (7) 1 mm. (8) ?. (9) Retracted to left. (10) Bone resected, metal plate implanted. (11) ?. (12) None. (13) ?.

CASE 173 (1) Saritscheu. Cited by Orlow. (2) F. (3) 1894. (4) ?. (5) ?. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Bone resection. (11) ?. (12) None. (13) Good function.

CASE 174. (1) Rechnitz. Cited by Orlow. (2) 24, M. (3) 1891. (4) ?. (5) ?. (6) Bilateral. Fibrous. (7) ?. (8) ?. (9) ?. (10) Resected coronoid processes. (11) ?. (12) None. (13) ?.

CASE 175. (1) Rose. Cited by Orlow. (2) ?. (3) ?. (4) ?. (5) Congenital. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Resected condyloid processes. (11) ?. (12) None. (13) ?.

CASE 176. (1) Sklifassewski. Cited by Orlow. (2) 18, F. (3) 1881?. (4) 13 yrs. (5) Scarlet Fever. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Resection of maxilla. (11) ?. (12) None. (13) Good.

CASE 177. (1) Kustetzow. Cited by Orlow. (2) 10, F. (3) ?. (4) 3 yrs. (5) Scarlet Fever. (6) Unilateral. Bony. (7) ?. (8) ?. (9) Atrophy of jaw. (10) Resection of joint. (11) ?. (12) None. (13) Good.

CASE 178. (1) Beresowski. Cited by Orlow. (2) 14, F. (3) 1901. (4) ?. (5) Measles. (6) Bilateral. Bony. (7) ?. (8) ?. (9) ?. (10) Bilateral resection of condyloids. Implanted muscle. (11) ?. (12) Salivary Fistula. (13) ?.

CASE 179. (1) Baumgartner. Cited by Orlow. (2) 5, M. (3) ?. (4) ?. (5) Congenital. (6) Bony. (7) ?. (8) ?. (9) ?. (10) Mass of bone removed. (11) ?. (12) Fistula. (13) Fibrous adhesions.

CASE 180. (1) Penrose. Med. News, 1890, lvii. (2) 28, M. (3) Apr. 1890. (4) 4 yrs. (5) Acute artic. rheumatism. (6) Bilateral osseous. (7) None. (8) Operation with recurrence. (9) ?. (10) Vertical incision in front of ear. Horizontal along lower edge of zygoma. Portions of neck ⅓ inch thick excised. (11) ?. (12) Stiffness overcome by rubber wedge. (13) ¾ inch opening.

CASE 181. (1) Warner. Charleston M. J., 1858, xiii. (2) 17, M. (3) Feb. 1855. (4) 4 yrs. (5) Mercurial ptyalism. (6) Right Fibrous. (7) Slight lateral. None down. (8) ?. (9) ?. (10) Cutting of fibrous bands. (11) ?. (12) None. (13) Permanent cure.

CASE 182. (1) Traval. Sicilia Med., Palermo, 1891, III. (2) 9, M. (3) Sept. 5, 1890. (4) 7 yrs. (5) Measles followed by ulceration. (6) Osseous, complete in right, incomplete on left. (7) Slight on left. (8) Dilatation. (9) Chin poorly developed. (10) Chiseled through osseous cicatrix. (11) ?. (12) None. (13) Good opening 2 cm.

CASE 183. (1) Baiardi. Bull. d. Chir., Milan, 1891, VIII. (2) 2½, F. (3) ?. (4) From birth. (5) Arrest of develop. of mandible. (6) Left fibrous. (7) Slight open. No lateral movement. (8) ?. (9) Slight atrophy of jaw. (10) Resection of condyle and coronoid process on left section of masseter. (11) ?. (12) None. (13) Satisfactory.

CASE 184. (1) Leroy. Kieferklenme-uibrebehandling. Diss Berlin., 1885. (2) 18, F. op. by Sonnenburg. (3) June 22, 1885. (4) 14 yrs. (5) Purulent inflammation of right jaw. (6) Right. (7) None. (8) ?. (9) Retreating chin drawn to right. (10) Resection of condyloid process. (11) ?. (12) None. (13) Good. 3 cm.

CASE 185. (1) Lando. Op. by Riche Traitement de l'ankyloscosseuse These de mont pellies. 1905. (2) 26, M. (3) Mar. 2, 1905. (4) 14 yrs. (5) Osteomyelitis of left jaw. (6) Left osseous. (7) 2 mm. on left, 5 mm. on right, no lateral. (8) ?. (9) Slight arrest of development. (10) Bony mass found. No trace of normal parts. Piece 5–6 mm. long removed. (11) ?. (12) Hemorrhage from internal maxillary. (13) Failure suggests congenital ankylosis.

CASE 186. (1) Murphy. Surg. Clinics, V. 2, June 1913. (2) 28, M. (3) ?. (4) 4 yrs. (5) Abscessed molar tooth. (6) Right Fibrous. (7) None. (8) Op. Thru mouth. Failure. (9) ?. (10) Cicatrices divided. Two flaps interposed. One from roof of mouth and other from hard palate. (11) ?. (12) None. (13) Permanent result, not known.

CASE 187. (1) Gindus. Med. de La Suisse Romande, 1902, V. 22. (2) 16, F. (3) Nov. 30, 1895. (4) 10 yrs. (5) Fall on chin. (6) Bilateral, osseous. (7) 3 mm. (8) ?. (9) Retreating chin, jaw undeveloped. (10) Resection of bony mass which concealed normal parts. (11) ?. (12) None. (13) Good at end of 5 yrs. Chin had developed considerably.

CASE 188. (1) Wernher. Ztschr. f. d. ges med., 1850. V. 44. (2) 23, M. (3) ?. (4) 20 yrs. (5) Scarlet Fever followed by mercurial ptyalism. (6) Bilateral osseous. (7) None. (8) ?. (9) Chin undeveloped. (10) Bony cicatrices connected upper and lower jaws beginning at front molar teeth. Piece of bone removed from each of these. (11) ?. (12) None. (13) Opening of more than ½ inch.

CASE 189. (1) Jonesco. Bull et mém. Soc. d. Chir. de Bucarest, V. 6. 1902–3. (2) 20, F. (3) Oct. 1902. (4) Since infancy. (5) Otitis Media. (6) Right osseous. (7) None. (8) ?. (9) Retreating chin. (10) Resection of ascending ramus. (11) ?. (12) Severe hæmorrhage. (13) Good.

CASE 190. (1) Baross. Ein Fall von Kieferklemme Ungar med. Presse, 1897. (2) 22, F. (3) ?. (4) 10 yrs. (5) Fracture of jaw. (6) Left osseous. (7) None. (8) ?. (9) ?. (10) Resection of piece of bone 5 cm. long from body of maxilla in front of cicatrix. (11) ?. (12) None. (13) 2 cm. opening.

CASE 191. (1) König. Deutsche med. Wchnschr. 1904. (2) M. (3) 1903. (4) ?. (5) Osteomyelitis of jaw. (6) Right osseous. (7) None right, slight left. (8) Op. on at 7 yrs. of age and again at 22 with recurrence. (9) ?. (10) Resection of triangular wedge from ramus. (11) ?. (12) None. (13) Good after several months.

CASE 192. (1) Mozzoni. Rep. by Zpfelin. Thèse de Paris, 1886. (2) 27, F. (3) 1878. (4) 8 mos. (5) Luxation from jaw. (6) Irreducible luxation both sides. (7) 2 cm. (8) ?. (9) Lower jaw thrust forward. Mouth open and immovable. (10) Resection of condyles but not removed because muscular action pulled them back in place. (11) ?. (12) None. (13) Excellent.

CASE 193. (1) Von Moorsel. Nederl. Tijdschr v. Geneesk., 1910, xlvi. (2) 7 mos., M. (3) 1910. (4) From birth. (5) Congenital. (6) Bilateral osseous. (7)

Slight. (8) ?. (9) Retreating chin. (10) Resection of wedge shaped piece from ascending ramus. (11) ?. (12) Hæmorrhage. Temporary facial paralysis. (13) Good. Child died few weeks later from convulsions.

Case 194. (1) Fabrikant. Russ. med. Rundschau, 1908. (2) 18, M. (3) June 30, 1907. (4) 8 yrs. (5) Scarlet Fever followed by mastoiditis. (6) Left osseous. (7) ¼ cm. between incisors. (8) ?. (9) Left side of chin much retreated, displaced backward. (10) Excision of 2 cm. bone from ascending ramus. (11) ?. (12) None. (13) Good 3 cm. opening.

Case 195. (1) Armour. West Lond. M. J., 1905. (2) 26, F. (3) Jan., 1905. (4) From infancy. (5) ?. (6) Bilateral osseous. (7) None. (8) ?. (9) Lack of development of horizontal ramus. (10) Cut through sygoma just in front of and behind tuberosity and neck of jaw. (11) ?. (12) None. (13) Good.

Case 196. (1) Bogoyavlenski. Khirurg. Mosc., 1910. (2) 22, M. (3) Feb. 24, 1909. (4) Since childhood. (5) Inflammation of jaw with discharge of sequestra. (6) Not given. (7) None. (8) None. (9) Bird's beak appearance. (10) Resection of piece of asc. ramus. 1 cm. long, first on one side and a little later on another. Interposition of flap of buccinator muscle. (11) ?. (12) None. (13) After op. on first side opening of 2 cm., after second op. opening of 4 cm. Appearance much improved. Chin less retreating.

Case 197. (1) Miratvorilz. Vrach. Gaz. St. Petersb. 1910. (2) 5, M. (3) June 25, 1907. (4) 2 yrs. (5) Scarlet Fever. Bilateral otitis media. (6) Bilateral. (7) Forcible stretching. (8) None. (9) Lower jaw and chin poorly developed. (10) Section of ascending rami at junction of upper and middle third masseter muscle interposed. (11) ?. (12) None. (13) Opening of 3 cm. Horizontal and vertical movement. Birds beak appearance less marked.

Case 198. (1) Dr. Francis Reder, St. Louis. Unpublished. (2) 26, F. (3) ?. (4) 7 mos. (5) Noma following typhoid Fever. (6) Bilateral. (7) None. (8) Jaws locked. (9) ?. (10) Skin flap from neck introduced into the mouth and attached to buccal site. (11) ?. (12) None. (13) 2 yrs. after operation able to open ⅔ its normal extent.

Case 199. (1) Dr. Francis Reder, St. Louis. Unpublished. (2) 14, M. (3) ?. (4) ?. (5) Compound fracture of lower jaw followed by infection. (6) ?. (7) ?. (8) ?. (9) ?. (10) Similar operation. (11) ?. (12) None. (13) Excellent.

# THE TREATMENT OF INOPERABLE CARCINOMA OF THE UTERUS BY APPLICATION OF HEAT[1]

By J. F. PERCY, M. D., Galesburg, Illinois

At the present time the treatment of cancer may be easily differentiated into two classes. The first of these is the operable, which applies almost wholly to early manifestations of the disease; and the second, the inoperable, which concerns us most at this time.

Inoperable carcinoma may be attacked through attempts to destroy the possible cause, by vaccines, toxins, serums, etc.; again, by attempts to change the pabulum by which the disease is permitted to progress, such as may be suggested by the theory, advanced by Ehrlich, under the name of athrepsia. From the standpoint of the experimental laboratory, the above theories and the work based upon them widen our mental horizon, and stimulate our imagination regarding the whole field of cancer research; but we cannot apply them now, because their value is yet undetermined, and the particular pabulum, or food stuff, which Ehrlich presupposes for growth, is not fully understood.

We do know, however, that the cancer-cells can be destroyed by the same agents that will destroy the normal cells; among these may be mentioned caustics, chemicals, actual cautery, and freezing. Our problem is to find, in some manner, an agent which will affect the physical properties of the growth in such a way as to kill the cancer-cell; if this cannot be done completely, then to retard or inhibit its growth, permitting normal cells to retain their growth and function. Certain agents have been found to which carcinoma is more vulnerable than are normal cells. One of these is radio-activity in its various forms. Unfortunately, the area of application of this agent is limited to such a degree that we are compelled to search for some other element of wider application.

In our study of agents that will inhibit and destroy carcinoma, the first that appeals to us is heat. The history of the ancient and modern use of this method of treating carcinoma is neither unimportant nor insignificant; only our manner of using it has been at fault.

In 1905, Paul Ehrlich suggested to M. Haaland (1) the greater susceptibility of certain strains of mixed, inoculable, malignant material to heat. The experimental work, based upon this fundamental intimation of Ehrlich regarding heat, has not only been interesting, but of great practical value. Haaland showed that carcinoma-cells are more vulnerable to heat than are those of sarcoma, and die after an exposure of one-half hour to 44° C. (111.2° F.). It has been demonstrated by Clowes (2) that all tumor-cells exposed to a temperature of 45° C. (113° F.) *in vitro*, die.

Loeb (3) has demonstrated the death of sarcoma-cells when exposed to a temperature of 45° C. (113° F.) for thirty minutes, while Clowes (3) and Baeslack place it at 44° C. (111.2° F.) for the same period of time. Jensen (3) places the vulnerability of cancer-cells at 47° C. (116.6° F.) for five minutes.

Lambert (4) has shown a definite relationship of damage between the degree of heat and the time of exposure to both normal and malignant cells. His investigations have demonstrated that sarcoma-cells are destroyed when exposed to a temperature of 42.5° C. (108.5° F.) for from twenty-four to forty-eight hours, 43° C. (109.4° F.) for six hours, 44° C. (111.2° F.) for fifty minutes, and 46° C. (114.8° F.) for twenty minutes; while the normal connective-tissue cells survive these various exposures. M. Doyen has shown that the death-point of carcinoma-cells is 55° to 56°C. (132° F.). An identical degree of heat is necessary to destroy the micrococcus neoformans, which he believes is the etiological factor in cancer.

E. Vidal (5) in a most interesting observation noted the arrested development of tumors in four patients, with a temperature above 40° C. (104° F.). Fearing that his

[1] Read before the Clinical Congress of Surgeons of North America, London, July 30, 1914.

experience in these cases was a mere coincidence, he daily exposed tumor-bearing mice to temperatures above normal, and found not only that their tumors showed degenerative changes, but that the mice lived longer. A spontaneous lymphosarcoma, which developed in a bitch, also diminished rapidly and finally disappeared, when the temperature rose to 40.8° C. (105.4° F.) after the puncture of the zone of Richet. These observations and experiments of Vidal are startling in their significance, and give tremendous point to his statement that all the methods for treating carcinoma which have come out of the experimental laboratory have no beneficial influence whatever, unless the reaction which they initiate is accompanied by fever. This is true of all vaccines and toxins, such as the nectrianin of Bra, Doyen's micrococcus neoformans, the toxins of Coley, and the vaccine of Otto Schmidt. The experiments of Bier (6) show that the intravenous injections of foreign defibrinated blood raises the body temperature, and this is true also of the use, in the same way, of the colloids of gold, silver, and copper. The observation of the older physicians, who noted the disappearance of malignant activity following infection by erysipelas, claims our interest in a new way. Pierre Delbet has confirmed the experiments of Vidal on the deleterious action of increased body temperature in cancer.

Reduced to the simplest statement, our problem in inoperable cancer has always been twofold: first, to get rid of the gross mass; second, to destroy the progressive metastases. The second point usually loses much of its significance in the overshadowing presence of the primary great mass. If what Vidal and others tell us is true, it is a rational procedure to attack these morbid masses with heat. But a method tending to raise the temperature of the whole body above 40° C. (104° F.) is impracticable, because dangerous. In addition, it is uncertain, and we cannot regulate it. We are compelled, then, to find some method more local in its application which will exert the greatest destructive process on the gross mass of cancer and endanger, to a minimum degree, the normal connective-tissue cells.

The only agents so far found worthy of consideration are hot air, hot water, steam, electrocoagulation, fulguration, and actual cautery. Hot water, hot air, and steam are shown by Doyen to be of no practical value, because of their slight penetration. Electrocoagulation affects the tissues for a depth of 5 to 8 cm. in two minutes. The rapidity of action, the difficulty of control of the electrode,— especially in the cavities,— the complicated apparatus necessary, together with the refinement of technique and specialized judgment required of the operator, make this method impracticable in the treatment of the cavity carcinoma. The de Keating-Hart method of fulguration (7)—i. e., the sparking from a high-frequency current of high tension, after the surgical removal of the bulk of the mass especially when superficial — is worthy of notice in this connection. In the hands of the originator, by preventing relapses, it has undoubtedly improved the statistics of operative methods in advanced cancer over those where cutting procedures alone have been employed. Durig and Grau (8), however, insist that the only beneficial result from fulguration is due alone to the heat, and not to any specific action on the tissue-cells. It is only just to the originator of this method of using high-frequency currents to state that he denies that this is the mode of action in his method. He insists that where heat is obtained in this way it is due to the reduction in the length of the spark, replacing the tension by thermic effects, which is a mistaken use of fulguration.

The methods just enumerated, in the hands of their originators, have added much to our knowledge of cancer therapy. But the apparatus required to carry out the technique is extensive, complicated, and expensive. In addition, to be effective, it demands not only specialized knowledge, but a refinement of judgment that requires more than the average experience.

In the way of comparison, it has been my pleasure to suggest a practical system of applying heat in otherwise inoperable carcinoma of the uterus which has none of the objections that can, with reason, be urged against the methods already enumerated (9).

The penetration of heat by this method can be definitely, although perhaps crudely, determined and regulated. Where the malignant process is at all accessible, the method has almost no limitations. The required apparatus is not only easily portable, but also inexpensive. I refer to the development of heat through a most efficient electric heating iron, which can be perfectly regulated by means of a rheostat, when applied to the involved tissue. With this electric heating iron and my water-cooled speculum, and the vaginal dilator, a maximum penetration and dissemination of heat is obtained in the involved structures. More than this, the low degree of heat, which my experiments show to be more effective than the intense heat already mentioned, can be maintained accurately. This low degree of heat does not burn up the cancerous mass, but merely makes it so hot that the hand of the surgeon, encased in a medium weight rubber glove, cannot hold it. When this degree of heat is reached and maintained for from ten to twenty minutes, the cancer-cells are absolutely killed, while the normal tissue-cells are not injured. The important thing is not to convert the pathology into charcoal. The charcoal, or carbon, thus formed inhibits the further dissemination of heat, not only through the cancer mass, but beyond. More than this, when the pathology is converted into charcoal, drainage is prevented for a number of days. This permits of the absorption of a larger quantity of broken down cancer-cells than the average of these patients can tolerate; and many of them die as a result of this mistaken method of applying heat. Carbonization is produced in a few minutes by a cautery heated to a bright cherry-red color. Carbon inhibits the dissemination of heat. To overcome this, still greater degrees of heat are required, which are extremely difficult to control, endangering the rectum, the bladder, and the ureters. In another publication (10) I have given the details of some experimental work which well illustrate the practical application of this very important factor. The heating iron, when used through the water-cooled speculum, should not be hot enough to scorch a pledget of white cotton, if laid on the heating iron even for half an hour. No smoke or smell of burning tissues should issue from the speculum, as would occur if they were being carbonized. The ear placed near the speculum should hear only a gentle simmer or bubbling, while the heating head is in the diseased mass.

My experimental work, and the operation itself, demonstrate that when this "cold iron" is applied to the affected tissues, not only is there much less destruction of normal cells, but a far greater penetration of heat, sufficient to kill carcinoma. Cancer is destroyed when the temperature in the mass is raised to 50° C.–55.5° C. (122° F.–131.9° F.); while the vitality of normal tissues is not changed until the temperature exceeds 55° C. to 60° C. (131° F. to 140°F.). The basic idea, then, of this treatment — and this cannot be too often emphasized — is not cauterization, but the production and dissemination of heat in the gross primary mass of cancer. There is no other method, or technique, familiar to me that will influence, in a destructive way, so great an area of malignant tissue, with a minimum amount of harm to the uninvolved structures. This technique, in a tremendously effective way, destroys the primary malignant focus. With this accomplished, the newer methods, especially the X-ray, that have been shown to be of supreme value in the destruction of the small isolated foci, in or just outside of the pelvis, make a combination of effort in the management of these otherwise hopeless cases, most promising in its possibilities. From my experience, I am convinced that it is not always best to attempt to destroy, at one sitting, a large mass of carcinoma. These patients are rarely in the condition which invites long anæsthesia. The application of the heat, to a degree which devitalizes the major part of the exuberant overgrowth, and rids the patient of her local focus of mixed infection, produces within two weeks a surprisingly beneficial result. This is especially noticeable if cachexia has at all been a marked symptom. A second or even third application of heat is not only safer, unless the involved structures are small, but it gives the operator a much better opportunity to reach, finally, the outermost confines of the disease.

When my technique in the application of

heat in these cases is decided upon, I would strongly advise against the use of the curette, or other operative measures, for the reason that the heat is distributed through the medium of the pathological overgrowth, which we wish to destroy. Heat does not encourage the extension of metastases, while the curette and knife do. Again, scar tissue is not formed after the use of the curette, but it is the usual sequel after the application of the heat; and I have yet to observe the redevelopment of cancer in cicatricial tissue. Where the surgeon believes that a modern total hysterectomy should be the operation of choice in the less extensive forms of uterine carcinoma, I know of no more rational procedure than the methods here outlined, which should precede the final operation, at least, by three or four weeks. In a personal case, where this treatment was applied to an active, stinking, bleeding, vegetative-like mass, springing from the craterous edges of a practically destroyed cervix uteri, no evidence of carcinoma was found on serial section eight months afterwards, when the uterus and cervix were removed through the abdomen.

I shall leave the statistics of my results in the treatment of inoperable carcinoma for a future paper. All that may be said at this time is that I believe that a large number of cases, if not practically hopeless when first presenting themselves for treatment, will give approximately fifty per cent remaining free from recurrence over five years. In addition, my work along this line convinces me that the limits of benefits to be obtained by the application of heat in inoperable carcinoma have not yet been reached.

I am working out a method by which the amount of heat entering both the pathological and normal tissues can be accurately gauged. With this, the degrees of heat in the tissues at various distances from the heating head can also be determined. This will make it more definitely and accurately certain that the required temperature known to destroy cancer is entering the parts involved.

The management of complications, the most serious of which is the prevention of rather late hæmorrhages, is a matter of importance. In fifty cases, this sequel has followed in two private and in two clinic cases. Only one of these, a private case, died from the hæmorrhage. It will probably prove to be true that the uterine arteries, or, possibly even the internal iliacs, should be tied in every case immediately preceding the treatment by heat.

In mentioning these important problems growing out of the practical application of my method, I do not wish to be understood as minimizing the great benefits which this technique has already given to a rather large number of otherwise hopeless cases of inoperable cancer of the cervix and body of the uterus; but rather to express the hope that with the improvement which can undoubtedly be made in the use of heat in cancer, a wider application of this extremely valuable method may be found.

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# THE RESULTS OF RADICAL OPERATIVE TREATMENT OF CANCER OF THE UTERUS[1]

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## HISTORY

THE operative treatment of uterine cancer has made slow, but on the whole continuous, progress since surgery was made safe by the work of Lister and Pasteur. Until thirty years ago surgical intervention was practically limited to cancers of the vaginal cervix, and the operation was done with the actual or galvanic cautery. In 1882 Pawlik reported 136 infravaginal amputations of the cervix performed by C. Braun with the galvanic écraseur; ten patients died, and of the survivors at least twelve remained free from recurrence for five years and upwards. Byrne in 1889 had done 81 cases by the galvanic cautery, and in 35 there had been no return of the growth for periods varying from 3 to 17 years. The operation was limited in its scope, and was soon superseded by Schroeder's supravaginal amputation of the cervix, which was applicable to a larger proportion of cases, had a mortality varying at first from 8 to 12 per cent, and was followed by freedom from recurrence for two and three years in about 40 per cent of those reported. In this country Lewers did 33 of these operations, in six of which the patients remained well for more than five years; the operable ratio is not given, but was probably much less than 20 per cent; the five years' absolute curability would thus not exceed two per cent.

Vaginal hysterectomy was first performed on regular anatomical lines by Czerny, and in the later eighties began to displace the supravaginal amputation in England. The first important discussion on the subject took place at the Obstetrical Society in 1885 when W. Duncan introduced two tables of collected cases, one showing 137 cases of abdominal extirpation of cancerous uteri with 99 deaths, an immediate mortality of 72 per cent; and the second table embracing 276 cases of vaginal hysterectomy with 79 deaths, or 28.6 per cent mortality. The general conclusion arrived at in the paper and subsequent discussion was that the risks practically condemned vaginal hysterectomy as an operation for cancer. Seven years later, in a review of the subject in the "Journal of Obstetrics and Gynæcology of the British Empire," I examined the literature of the subject, and showed that in competent hands the operation was applicable on an average in from 25 to 33 per cent of the cases which applied for treatment; the immediate mortality was 5 per cent or less; 25 to 33 per cent of the cases that survived the operation remained well and free from recurrence for five years and upwards; and the absolute curability of uterine cancer by this operation varied between about 4 per cent (Schauta ap. Waldstein) and 9.2 or 10 per cent (Winter and Kaltenbach).

In the same review reference was made to the extended operation performed with the help of a vaginoperineal incision, by means of which the parametrium could be widely removed. In 1901 Schuchardt had reported on 60 such cases, and claimed an absolute curability of 24 per cent of the number of cases presenting themselves for treatment. Since then the operation has been largely practiced by certain operators, and its advocates claim that access to the seat of operation is as good, that the danger of injuring neighboring structures is less, and that as wide a removal of the parametrium can be made by this route as by the abdominal. The dangers of bleeding and sepsis seem to be little inferior to those of the abdominal operation, and the risk of implantation of cancer-cells would appear to be equally great.

By the extended vaginal operation Schauta, until 1911, obtained a five years' absolute curability of 16.6 per cent on 211 operations for cervical cancer performed in a series of 447 cases applying for treatment. The primary mortality was 8.9 per cent, but in

[1] Read before the Clinical Congress of Surgeons of North America, London, July 30, 1914.

the last three years had been reduced to 3.7 per cent.

In this country the chief exponent of this operation was Sinclair, of Manchester, and since his death the method appears to have fallen almost entirely into disuse. Among my own early operations I made use of the vaginoperineal incision in a few instances, but in the second case, one of cancer of the body, an implantation metastasis arose in the vaginoperineal scar within a few months; after that I ceased almost entirely to employ this incision in operating for uterine cancer.

At about the same time as the extended vaginal operation was being worked out, the example set in the surgery of mammary cancer stimulated operators to endeavor to find a method of removing the uterus together with its neighboring connective tissue and lymphatics. Hysterectomy by the abdominal route was, therefore, once more attempted, and in 1895 Clark and Rumpf first dissected the ureters in order to remove as much of the parametrium as possible, and Ries proposed the removal of the pelvic lymphatic glands. In 1898 Wertheim in Vienna began the remarkable series of operations which has served to establish the operation and make it known by his name in all parts of the civilized world. For the last ten years this operation has been gradually displacing the extended vaginal hysterectomy, which is now regarded as its only possible rival. The immediate results are steadily improving and many of the dangers and disadvantages of the operation have been overcome; thus suppuration and sloughing of the abdominal incision with consequent hernia are now prevented by carefully guarding the incision during the operation; septic peritonitis is prevented by suitable vaginal antisepsis; and shock and exhaustion become less common with increasing experience.

Surgeons attach great importance to the use of the actual or galvanic cautery in operations for uterine cancer; in this country Herbert Spencer is the chief advocate of this method. In America Byrne achieved remarkable success by its use, and X. O. Werder has recently very strongly recommended combined vagino-abdominal hysterectomy by the cautery method; in his hands the method has given an absolute five-year curability of 16.5 per cent in 39 cases.

In this country the abdominal operation is becoming the routine method, because, in the first place, it affords better oversight of the field of operation than the vaginal method; in the second place, because operations by the vaginal route have never been extensively practiced here, and thus skill is easier of attainment in a new operation if it is performed by the abdominal method; and thirdly, because by the abdominal route alone it is possible to remove the affected glands. This last advantage is likely to prove of increasing value in the future. Many operators in their haste have concluded that it is useless to remove the glands, and have stated that when they are invaded the disease always recurs after operation. Wertheim has, however, published 14 cases in which carcinomatous glands were found, and which nevertheless remained free from recurrence for upwards of five years. For the reasons stated the abdominal operation is likely to become more and more generally adopted. It cannot, however, be applied in all cases. The prolonged Trendelenburg posture is dangerous for old patients, for those who are very fat, and for certain women with visceral complications. In such cases the vaginal operation affords a better immediate outlook, and in the old patients especially is often followed by a long freedom from recurrence.

### DIFFICULTIES OF ESTIMATING RESULTS OF OPERATIONS FOR CANCER

The difficulties of estimating justly the results of any curative method of treatment of cancer are very great by reason of the uncertain course and duration of the disease. Cancer does not grow with equal steps, but now halts, again recedes, and anon makes rapid and tumultuous progress. In different patients the earliest symptoms make their appearance at various stages of the disease. When cancer begins in the uterus one patient has recognizable symptoms at the very beginning, while another is conscious of nothing unusual until the disease is already very far advanced. The duration of the disease is in

the highest degree uncertain: of two women with the affection apparently at the same stage one may die in a few weeks and the other live for several years. In the practice of the operating surgeon, groups of cases, successful as regards ultimate cure, alternate with other groups apparently similar, but all ending in rapid recurrence. All these things tend to show that the actual living virus of cancer, when at length it is discovered, will be found to pass through varying phases of growth and activity, now active and virulent, now stationary or sluggish.

These uncertainties in the course of the disease have been illustrated, and to some extent explained, by the experiments on mouse cancer. Here, also, marked variations are observed in the rate of proliferation of the cancer-cells. Some tumors on inoculation grow rapidly, certainly, and progressively; others increase slowly; still others tend to regress and disappear; and all degrees of virulence are found between these extremes. The tumor-cells exhibit what may for convenience be called positive and negative phases of proliferative activity.

On the other side, marked differences exist in individual hosts as well as in the various organs and tissues of the body. In some organs and persons cancer appears to take root easily; it grows rapidly and soon becomes generalized. In some very early cases of uterine cancer, the regional glands are already invaded; while in patients dead of the disease the glands are reported to be free in as many as 54 per cent. The same uncertainty is illustrated in the varying fate which befalls tumor-emboli in the lungs of patients with malignant chorio-epithelioma. Relative immunity varying in degree resides in some organs and tissues, and in certain individuals. Not every person exposed to the causes of cancer, whatever these may be, develops the disease. Many are called, but few are chosen.

Here, then, are two factors which go far to explain the impossibility of forming an opinion as to the course of the disease and as to the probable result of operation in any individual case. Little that is definite is known of either of these factors and we can only hope that patience and perseverance will eventually lead to their elucidation. In the meantime, the uncertainty and variability of the disease render it imperative that, in forming an opinion as to the results of any method of treatment, observations shall be made on a large number of cases, and shall extend over a very considerable time. Averages are of use in comparing results in the mass, though they are of none in individual prognosis.

### STANDARD FOR COMPARISON

In estimating the risk of any new operation it has always to be borne in mind that while there are dangers inherent in the operation, there are also dangers that appertain to the operator. The first ten or twelve operations carried out by an individual surgeon usually teach him most of the difficulties and dangers that are encountered, and with increasing experience the mortality due to the personal factor rapidly diminishes. The bearing of this remark lies in the application thereof. I think it would be just to exclude from the general consideration of the subject the first ten or twelve cases of Wertheim's operation done by each individual operator. In this way a true idea of the danger due to and inseparable from the operation itself might more easily be formed.

In proportion as the operation for uterine cancer has become more extensive, the demands as regards ultimate cure have become more exacting. At first, since the average duration of the disease from the onset of symptoms to the death of the patient was understood to be one and one-half years, freedom from recurrence for two years after operation was a surgical triumph; then a term of three and later of five years' freedom was demanded. Latterly it has been suggested by Weibel, among others, that the term should be extended to seven or more years, inasmuch as a certain number of patients show late recurrence. That this undoubtedly happens was shown in three of my patients in whom the disease returned after six, six and one-third, and nine and one-half years, respectively. But art is long and time is fleeting, and the necessity is urgent of a convenient and sufficient standard to

enable us to estimate and compare results. For this purpose five years would seem to answer all legitimate requirements, and it is to be desired that published results should conform to this standard.

Only those who have examined published writings with a view to find out what the operations for uterine cancer can fulfill can appreciate the chaos and confusion that have arisen from every writer setting up his own standard. The literature of the subject is largely made up of attempts to estimate the value of the different operations by arithmetical methods which bristle with fallacies of every conceivable kind. The higher mathematics has been called upon to assist, for instance, in the formulæ of Winter and Waldstein. To the making of statistics there is no end, and many figures are a weariness of the flesh. All complicated formulæ are superfluous, and it appears to me the only fairly reliable estimate of results can be made by comparing the total number of cases of cancer that apply for treatment with the number known to be free from recurrence five years later. And even here there are many opportunities for error.

Another important observation, that should be, but is not, superfluous, must be made: that under no circumstances is it any longer justifiable to publish the mixed results of treatment of cancer of the body and cervix. The two varieties should be kept entirely distinct and should be separately discussed.

In the large German clinics we find that cancer of the uterine cervix affords a ratio of operability of 45 to 60 and even higher, and an absolute curability of 20 per cent; Wertheim's five-year completed statistics of 450 cases show an operable ratio of 46 per cent, with a primary mortality of 19.5 per cent, and an absolute curability of 19 per cent, 186 of 979 patients being known to be alive and free from recurrence at the end of five years.

In this country, with rare exceptions, the operability is not greater than from 30 to 40, and the total curability than 10 per cent. The low operable ratio is not due to any difference in the disease, but rather to the fact that the general public and the main body of the medical profession have not yet grasped the truth that uterine cancer is curable in a large proportion of those cases that apply early for treatment. The consequence of this ignorance is that women do not seek medical aid promptly and that when they do the necessary investigation is only too often delayed.

### THE SURGERY OF UTERINE CANCER IN GREAT BRITAIN

In Great Britain, as, generally speaking, in America, gynecological work is spread over a large number of clinics of small or moderate size, and the opportunities afforded to the individual operator are comparatively limited. In testing and establishing a new operation such as the extended abdominal hysterectomy for uterine cancer, this arrangement has many disadvantages when compared with the large clinics and extensive opportunities that are found on the European continent. To this more than to any other cause is probably due the fact that these operations have been practiced extensively and successfully in Vienna and Germany far in advance of the work that has been done here.

Published papers in the British journals on the extended operation for uterine cancer have been comparatively few, and, to a large extent, made up of descriptions of technique with occasional suggestions for its improvement. Hastings Tweedy in 1911 published notes of 48 cases of uterine cancer operated on by the abdominal method. Among these were included 33 operations for cervical cancer with an immediate mortality of 8, or 24 per cent. Comyns Berkeley has described the results obtained by him and Bonney in the three years ending June, 1910. Among 112 cases of cervical cancer, 71 were operated upon, an operable ratio of 63; the immediate mortality was 22.5 per cent, and the patients remaining free at the end of three years amounted to 40.5 per cent of those operated upon, or 54.9 per cent of those recovering from the operation. McCann, to June, 1912, had done 52 Wertheim operations for cancer of the cervix, with three deaths, and in the five years ending June,

1911, had seen only five inoperable cases. Cuthbert Lockyer and Childe have also discussed the operation. There are no British five-year statistics.

I propose now briefly to examine my own work on uterine cancer, which has been done in the gynecological department of the Birmingham General Hospital. This department has 14 beds, and is a fairly typical one in the country. In the last ten years most of the out-patients have been seen by the assistants in the department, Messrs. Hewetson and Beckwith Whitehouse, who have also performed some of the operations, and have assisted in most of mine. I have taken all the cases applying for treatment in the out-patient department, and all those admitted to the wards, and have added all my own private cases. My thanks are due to Miss M. B. Webb, M. D., whose very efficient and enthusiastic help in following up my results I here gratefully acknowledge.

From the year 1896 until December 31, 1913, there have been 596 cases of uterine cancer. Of these, in 67 the disease affected the uterine body, and in order to clear the ground I deal with these first. Among the 67, 15 vaginal hysterectomies, with no mortality, and 29 abdominal hysterectomies, with 3 deaths, were performed.

The five-year results are given in the accompanying table:

CASES OF CANCER OF THE UTERINE BODY SEEN UNTIL JUNE 30, 1909

Total cases seen, 50.
Radical operations, 31 = 62 per cent.
Deaths following operation, 2 = 6.4 per cent.
Cases free from recurrence for 5 years and upwards, 12.
Absolute curability = 24 per cent.

The absolute curability of cancer of the body of the uterus here shown appears small when compared with the rate of 50 to 75 per cent usually claimed, but I believe the latter rate is based largely on fallacies and small numbers, and will prove to be exaggerated.

CERVICAL CANCER

Until the end of 1913 there were 529 cases of cancer of the cervix uteri. These can be conveniently divided into two groups according as operation by the vaginal or the abdominal route was the method of choice. In the first period, lasting until the end of 1905, there were 246 cases, of which 37 were operated upon by the vaginal method with one death, and 7 by the abdominal route with 6 deaths. In the second period from January 1, 1906, to December 31, 1913, 283 cases were seen, among whom 20 were operated upon by the vaginal route with no deaths, and 72 by the abdominal with 8 deaths. The total immediate mortality of the vaginal method has been 57 cases with one death, or less than 2 per cent; and of the abdominal, 79 operations with 14 deaths, or 17.7 per cent. The great majority of the abdominal hysterectomies were performed by Wertheim's method.

The ratio of operability has steadily increased; in the years 1896 to 1899 it was 14 per cent; in the last four years it has been more than 36 per cent.

OPERABLE RATIO

1896–1905 inclusive, 18 per cent of 246 cases.
1906–1909 inclusive, 29.2 per cent of 154 cases.
1910–1913 inclusive, 36.4 per cent of 120 cases.

My total five-year results up to June 30, 1909, have been investigated, and show that with an increased operable ratio and the adoption of the abdominal method of operation, the absolute curability of my cases has risen from 5.5 per cent to 10.2 per cent.

RESULTS OF VAGINAL HYSTERECTOMY FOR CANCER OF THE CERVIX TO JUNE 30, 1909

52 operations in 288 patients.
Average operability about 18 per cent.
Death following operation, 1.
Patients survived 5 years and upwards, 16.
Absolute curability, 5.5 per cent.

ABDOMINAL HYSTERECTOMY FOR CANCER OF THE CERVIX TO JUNE 30, 1909

32 cases in 98 patients.
Operable ratio, 32.5 per cent.
Deaths following operation, 9.
Free for 5 years and upwards, 10.
Absolute curability, 10.2 per cent.

Of the patients surviving operation, 16 of 51 or 31 per cent of the vaginal, and 10 of 23 or 43 per cent of the abdominal, remained well

and free from recurrence for five years and upwards.

It follows from my experience that, although the final results hitherto obtained in this country are inferior to those of the best Continental clinics, they are steadily improving, and may be confidently expected still further so to do. The immediate mortality of the extended abdominal hysterectomy for cervical cancer has fallen; thus, in my own work, in the six years ending December 31, 1913, there were six deaths in 62 operations, a rate of about 10 per cent. The operable ratio has doubled in the last ten years and may be expected to rise considerably further when the possibilities of the operation are grasped by the profession at large and by the public. The total number of patients remaining free from recurrence for five years and upwards has also increased nearly twofold in the last decade, and we may hope before long with the surgical methods now at our disposal to achieve an absolute curability of 25 per cent of all cases of cancer of the uterine cervix.

Hardly a year passes free from the joyous announcement of new and certain cures for cancer. Every new treatment is hailed with acclamation, tried with enthusiasm, claimed to be almost consciously selective in its action on the cancer-cells, and then is dropped quietly into the oblivion of disappointing and forgotten things. Hitherto surgical methods alone have stood the test of time and have justified their use, not only by progressively improving results, but also by affording opportunities for increasing our knowledge of the pathology of the fell disease in the human race. The exact nature and the mode of origin of cancer are still veiled from our view, and the seer who shall expound these is eagerly awaited. In the meantime, it behooves us to continue to give to our patients the benefit of those methods which give the greatest promise, being neither unduly lifted up by success nor cast down by our many and grievous disappointments.

# ULCER OF THE STOMACH IN CHILDREN BEFORE PUBERTY[1]

By CHARLES. D. LOCKWOOD, M. D., Pasadena, California

ROUND ulcer of the stomach and duodenum in children before puberty is relatively rare, although I am convinced, from recent experience and from a review of the literature of the subject, that it is a much more common lesion than most surgeons realize. I believe that many obscure abdominal symptoms in children, heretofore ascribed to appendicitis, gastro-enteritis, ptomaine poisoning, and the like, are due to ulcers.

All authors whom I have consulted, save Jacobi, declare that true peptic or round ulcer of the stomach and duodenum is rare in children. The following statistics indicate the rarity of ulcers in children: Welch (1) found one case in a child under ten in a series of 607 cases of gastric ulcer. Dusser (2) in a series of autopsies at a children's hospital found nine cases of gastric ulcer and four of duodenal. Wallenstein, quoted by Osler, found five cases of gastric ulcer in 390 autopsies at the Baby's Hospital, New York City. Koplik reports only one case of gastric ulcer in his experience covering 300,000 cases of diseases in children.

After recognizing a case in my own practice and successfully operating upon it, I was stimulated to investigate the subject from the surgical point of view. This paper is based upon data gleaned from all medical literature to which I had access, upon personal correspondence with one hundred and fifty members of this association and all children's hospitals in this country and Canada, supplemented by a thorough review of American and foreign medical literature made for me by the Nelson Research Bureau.

Before reporting my own case and others collected by me, I will briefly discuss the etiology, pathology, and diagnosis.

*Etiology.* R. Fischl (Prague) ascribes the rarity of ulcer in children to the small amount of acid in the gastric secretions of children, and to the motility and rapid emptying of the stomach. Among predisposing factors may be mentioned the following: burns, especially in young children; wasting diseases, especially tuberculosis; local injuries, e. g., purpura, hæmophilea, leukæmia, septicæmia, scorbutus, anæmia and chlorosis in young girls; follicular gastritis (three cases reported by Holt).

*Pathology.* The pathology of peptic ulcer in children does not differ markedly from that in adults. The ulcers may be simple or multiple. In very young children they are more often superficial erosions, and the deep funnel-shaped ulcer so characteristic in adults is rare. In older children, more typical ulcers are found and perforation is common. Ulcers in children are relatively less frequent in the pyloric region. They are found most often on the posterior wall, near the cardia and along the greater curvature. Perforation in the majority of reported cases, confirmed by autopsy or operation, occurs through the posterior wall into the bursa omentalis, or through the lesser curvature into the pancreas. Many of the reported cases have been associated with tuberculosis, and it is often difficult to distinguish simple ulcer from tubercular erosions.

*Diagnosis.* The possibility of gastric ulcer should be kept in mind in the examination of every child presenting abdominal symptoms. Appendicitis is the condition most often confused with gastric ulcer. Ulcer has been overlooked at operation and discovered at autopsy. Pain in the epigastrium, hæmatemesis, and bloody stools are conclusive signs. The two latter are usually absent and pain is often indefinite and not well localized. Pain, worse at night, loss of weight, and chronic indigestion are usually present. These symptoms should suggest ulcer, and physical examination, aided by microscopic examination of the stomach contents and stools for concealed blood, will render the diagnosis conclusive. In my case the diagnosis was made through palpation of the pyloric region of the stomach. During a paroxysm of pain the gas could be felt to

[1] Read before the Western Surgical Association, St. Louis, November 19, 1913.

gurgle through the pyloric opening and was followed by immediate relief of pain. At varying intervals the child would cry out with pain; relaxation and complete relief would follow the escape of gas through the pyloric opening. I made the discovery in a purely accidental way, but I believe it is a most valuable diagnostic sign.

Gastric ulcer must be differentiated from pleurisy, empyema, acute gastro-enteritis, and appendicitis. Routine examination of the chest in suspected abdominal lesions will eliminate chest conditions simulating ulcer. Acute gastro-enteritis can be excluded by microscopic examination of the stools for concealed blood. Appendicitis, which has been often confused with ulcer, can be excluded by a differential blood-count and examination of the stools. The pain of appendicitis is often in the epigastric region and is rarely so well localized as in adults.

*Report of case.* Lillian B., age 13, had never been robust and had never menstruated, but up to January, 1912, was in normal health and engaged in all of the usual activities of children. At this time she was suddenly seized with pain in her left side. Pain was so severe that she cried out. A diagnosis of pleurisy was made at that time. She soon complained of pain in the abdomen, which she localized at times in the epigastrium and at other times in the lower abdomen. Appetite was good and food did not seem to distress her. She vomited but once and there was no macroscopic blood. Chief complaint was pain, worse at night, and paroxysmal in character. During paroxysm she would cry out and place her hand over the abdomen. Child was hungry and constipated.

*Physical examination.* Anæmic, emaciated girl of normal intelligence. Heart and lungs negative. Scaphoid abdomen, slight tenderness in epigastrium. Appendix palpable and slightly tender, no abdominal rigidity. Kidneys palpable but not tender. Black, tarry stools. Two blood-counts on successive days showed 9,000 to 18,000 leucocytes. Stomach analysis, free hydrochloric acid slightly in excess. Blood present. Microscopic examination of stools showed blood.

*Surgical treatment.* April 18th, abdomen opened by right rectus incision. Stomach found adherent for its entire length. Adhesions were especially dense at the pylorus and cardia. They were of cartilaginous hardness at the pylorus and it was impossible to draw the stomach outside of the abdominal cavity. Posterior gastro-enterostomy was impossible and an anterior operation was done with a long loop of jejunum. Even this was difficult on account of immobility of the stomach. An adherent retrocæcal appendix covered by a veil of adhesions was removed.

*Post-operative results.* All pain ceased after twenty-four hours. Food did not distress, digestion good. Patient very hungry. Bowels moved daily after third day without cathartics. For two months patient remained well and gained fourteen pounds in weight. She then began to fail. There was little pain, but all food was vomited and there was rapid emaciation. Her condition grew steadily worse until July, 1913, when I reopened the abdomen, hoping to reëstablish drainage, which röntgenograms showed faulty. At second operation, stomach, omentum, and transverse colon were so densely adherent to the abdominal wall that it was impossible to expose the stomach wall. Retroperitoneal glands were enlarged and all tissues involved were of cartilaginous hardness. I concluded the condition was malignant and inoperable. There was slight improvement after operation, and then there was steady decline until two weeks after operation, when she died of starvation.

*Post-mortem.* Deep ulceration on greater curvature where transverse colon, omentum, and jejunum were densely adherent. Infiltration of new growth around healed ulcer resembled cartilage. Pylorus was surrounded by this same dense tissue. Liver studded with metastatic growths. There was also a general metastasis, involving peritoneum, small intestine, cæcum at site of removed appendix, kidneys, retroperitoneal glands, etc. Dr. Stanley P. Black made diagnosis of primary sarcoma of stomach from gross specimen, but on microscopic examination tumor proved to be carcinoma, secondary probably to round ulcer of the stomach.

### CASES REPORTED IN LITERATURE AND ADDITIONAL CASES COLLECTED BY THE AUTHOR

There have been gathered from the literautre about 60 cases of gastric ulcer in children. These are reviewed by Stowell (3), by Cutler (4), and by Jacobi (5). I have collected, in addition to these, about 50 cases from the literature and 15 cases not previously reported, through correspondence, making about 125 cases in all. I shall report only those cases treated surgically at this time, and leave the remaining cases to be reported in the Transactions. Dr. F. B. Lund (6) reported a case operated upon by him, and was able at that time to find only two other cases treated surgically. I am able

to report the following cases subjected to surgical treatment:

OPERATED CASES

1. Author's case.

2. C. Bechtold (7) reports one case, a five-year-old girl. Five months before acute attack, she showed loss of appetite, general emaciation, and paleness, with slight pain in the abdomen. While playing, she was seized with severe pain in the abdomen, symptoms of appendicitis with peritonitis. Operation and death. The autopsy showed perforation of a round ulcer of the stomach.

3. W. Cheyne and H. Wilbe (8) report one case, a boy aged thirteen. Attack began with abdominal pain, becoming more severe. No vomiting, diagnosis of appendicitis. Operation. Appendix inflamed but not perforated, removed. Incision also made over the stomach. Round perforation found on the anterior wall near the cardia. Perforation closed with catgut. Cure.

4. G. K. Paterson (9) reports one case, a boy aged 12 years and three months. Illness began with pain in the epigastric region, continued for seven days, then a severe attack of pain in the abdomen with pain in the left shoulder also. Vomiting and symptoms of peritonitis. Operation. Perforated gastric ulcer found on the anterior wall of the stomach, about two inches from the middle of the lesser curvature. Peritoneum washed out, drainage. Lung complications, but final recovery.

5. Von Eiselsberg (10) reports a case in a female, age twelve years. Pain and vomiting of blood for a year. Dilatation of stomach and stenosis of pylorus. Gastro-enterostomy done with recovery.

6. Joseph Rilus Eastman, Indianapolis. (Personal correspondence.) Child thirteen years of age. Symptoms, pain, hæmorrhage, emaciation. Diagnosis prior to operation. Rodman ulcer operation. Result, benefited.

7. A. E. Halstead, Chicago. (Personal correspondence.) One case, age eleven. History of ulcer from first year of life. Severe hæmorrhage at three and one-half, four, and five years of age. Vomiting, nausea, emaciation. From seventh year on evidence of pyloric obstruction, distention of stomach. Enlargement of abdomen, motor function impaired. Meal retained after twelve hours. Diagnosis made at age of four, with diagram of probable ulcer after second severe hæmorrhage. Treatment, gastro-enterostomy. Large cicatrix, indicating saddle ulcer at pylorus. Recovery.

8. F. B. Lund (6) reports a case of a boy eight years of age, bottle fed. Symptoms, pain in the epigastrium, not related to meals, worse at night. Vomiting of blood, tarry stools. Temperature 101° to 102° F. Diagnosis made prior to operation. Treatment, medicinal. Rapid improvement, but symptoms soon recurred. Operation, gastro-enterostomy, posterior short loop. Large indurated ulcer near pylorus on lesser curvature. Firm adhesions to liver. Result, recovery.

9. Van Buren Knott, Sioux City, Iowa. (Personal correspondence.) Two cases, ages ten months and five years. Symptoms, hæmorrhage, blood in stools. Diagnosis made before operation in older child. Treatment, in child of five, gastro-enterostomy. Younger child, medicinal.

10. Dudley Tait, San Francisco. (Personal correspondence.) One case, 1904. Age thirteen. Symptoms, local and general signs of perforation. Diagnosis of peritonitis made before operation. Treatment, high laparotomy, with simple drainage. Recovery without relapse.

11. Jacob Geiger, St. Joseph, Mo. (Personal correspondence.) Two cases. Male, age eight; female, age twelve. Symptoms, gastric distention, loss of flesh and strength, hæmatemesis and bloody stools. Diagnosis made prior to operation. Treatment, gastro-enterostomy. Result not stated.

I have collected the following cases from the medical literature of all countries through the aid of the Nelson Research Bureau:

H. Adler (11) reports one case. Girl, age eight years. For ten weeks repeated attacks of pain in the epigastric region, occurring both before and after meals, nausea and vomiting. Blood in vomitus several times. Stools also showed blood. Five weeks ulcer cure with rest in bed, careful diet, and bismuth. Recovery with no recurrence in five months. Marked improvement in general condition.

C. F. Barker (12) reports one case. Boy, ten years old. A few days previous to acute attack complained of heaviness in his stomach, relieved by cathartic. Acute illness with prostration came on suddenly, death in a few hours. Autopsy showed four ulcers in the stomach, two of which had perforated.

C. Bechtold cites the following earlier cases:

1. Guntz's (13) case. A five-year-old boy, never very healthy, gradually lost flesh. Frequent vomiting, with occasional streaks of blood. After an attack of scarlet fever, bloody stools. Death. Autopsy showed adhesion of the posterior wall of the stomach to the colon and a perforating ulcer on the posterior surface of the stomach near the greater curvature.

2. Reimer's (14) case. Three and one-half year old girl, with digestive disturbances for over two years. During an attack of measles, diarrhœa, nausea, and gastralgia, followed by gastric hæmorrhage and death. Autopsy showed stomach adherent to the pancreas and a round ulcer on the posterior wall of about 4 cm. diameter. Recent peritonitis.

3. Chvostek's (15) case. Boy, died at eighteen, but had symptoms of gastric ulcer, attacks of severe pain, and constipation since the age of three, after exposure to severe cold, and was backward in general development. Autopsy showed two

ulcers, one at the cardia, the other at the pylorus. Pylorus narrow and musculature hypertrophied.

4. Erösss' (16) case. A twelve-year-old girl, dying of acute miliary tuberculosis, frequent gastric pain complained of. Appetite small. Section showed round ulcers in the stomach. One perforation into the bursa omentalis, which Erösss considered to be non-tuberculous.

5. Wertheimen's (17) case. A ten-year-old girl showed symptoms of gastric ulcer of the stomach (loss of appetite, pain and bloody vomit, and stools). Recovery in five weeks with careful dietetic treatment.

6. Malinowsky's (18) case An eight-year-old girl died, symptoms of gastric ulcer, especially vomiting of a large quantity of blood. No autopsy reported.

7. Cade (19) reports an autopsy of a two and one-half months old boy, who had suffered from yellowish diarrhœa and vomiting, showed a round ulcer on the posterior wall of the stomach that had perforated into the bursa omentalis, its anterior portion adherent to the liver.

A. G. Bisset (20) reports one case. Boy, forty-five hours old. Six hours before death began to bleed from bowels, rapidly collapsed, and died. Autopsy showed typical gastric ulcer of acute form, with clean-cut margins, on posterior wall of the stomach, near lesser curvature, about one-half inch from the cardiac opening. Perforated.

L. M. Bowes (21) reports one case, girl, age eight. Illness commenced by nausea and vomiting and occasional pain. Acute attack with severe pain in the epigastric region and vomiting. Vomitus acid and contained blood. Also blood in the stools during the attack. Pain controlled by morphine, alkalies given to neutralize acid. No recurrence in four months.

E. Cautley (22) reports one case, girl, five years and four months. Sometimes pain in the abdomen. Attack began with vomiting blood, stools constipated, black. Anæmia, enlargement of spleen. Improvement and cure under treatment, no return of symptoms. Diagnosis not certain, but author believes it to be a case of simple gastric ulcer.

M. von Cackovic (23) examined 172 cases operated on for gastric ulcer in regard to the first appearance of symptoms. He found that symptoms of ulcer appeared in four cases before the age of ten, in nine cases between the ages of ten and fourteen, or in 13 cases (7.55 per cent) in all during childhood. He reports but one case before puberty as follows:

Female, thirteen years old, pain began at age of eleven, vomiting at the age of twelve.

Cutler (4) reports three cases from the Massachusetts General Hospital, and in addition fifteen others, not included in my report, but reference to original paper is given above.

Rufz (24) reports the case of a girl thirteen years old. Symptoms of dyspepsia, death sudden from peritonitis. Perforation of stomach in smaller curature, following ulcer almost 2 inches broad.

Leith reports the case of a girl, age ten. A month after recovery from croupous pneumonia began to cough, left-sided empyema developed, causing death. Autopsy showed empyema cavity on the left side with perforation of the diaphragm, also blood in the intestines and an ordinary perforating ulcer, nearly circular in the stomach, just in front of the greater curvature, four and one-half inches from the cardiac end. Ulcer adherent by its floor to the spleen, and a suppurating track passed upward and inward between the adherent spleen and stomach directly to the perforation in the diaphragm.

Donné (26) reports the case of a girl three years old. Autopsy showed "in the midst of a punctated redness within the upper half of the small curvature, a little bit depressed beneath the surface of the mucous membrane, the size of a ten-sou piece. Divergent rays seemed to run out from its center in every direction. The depressed spot was also in folds and the fibrous tissue was thickened, showing a cure from a simple lesion."

Goodhart (27) reports a case in a new-born infant, sex not stated. Vomited blood and died in thirty hours. Autopsy showed stomach distended by blood clot, with small oval ulcer about one-eighth inch long at the cardiac end close to the greater curvature. Edge of ulcer very sharp, at the bottom an open artery. Cutler says he includes this case among the chronic ulcers from the "description of the ulcer. Perhaps it should be classed among the acute cases."

Lebert (28), giving statistics for Breslau, includes one case in his table of chronic simple gastric ulcer between the age of five and ten years, but no detailed statement of the case.

Delore (29) describes a post-mortem specimen of case reported in 1866 to the société de Med. de Lyon. Infant a few days old died of intestinal hæmorrhage. Autopsy showed several ulcers of the stomach, invading only the mucosa.

Faulhaber (30) reports in all thirty-two cases of ulcer of the pylorus, two of these in children as follows:

Case 1. Female, four years old. Periodical pain and digestive disturbances since birth. Diagnosis by röntgen ray. Medical treatment without cure.

Case 2. Male, five years old. Pain and digestive disturbances for a year. Diagnosis by röntgen ray. Medical treatment.

L. Fischer (31) reports two cases:

Case 1. Girl, nine years old. Generally backward in development. For some time bloody vomiting, tarry stools, stomach distended and tender. Prolonged medicinal and dietetic treatment for ulcer. Cure.

Case 2. Girl, fourteen years old. Long ill health. For three years vomited blood at times with frequent attacks of pain and vomiting after eating. Improvement under treatment, but relapse when she returned to work.

A. P. Francine (32), in his summary of the cases

of gastric and duodenal ulcer in the Philadelphia Hospital that came to autopsy in 1893–1902, gives the following cases in children:

Forty-two cases in all of gastric and duodenal ulcers.

Case 5. Male, eleven years old. Stomach shows a few small ulcers, tuberculosis of lungs and intestines.

Case 24. Female, age ten months. Small round superficial ulcer in stomach, gangrenous stomatitis, diphtheritic gastro-enteritis.

Case 25. Female, age three years. Small ulcer in the duodenum. Enterocolitis.

Case 26. Female, age twenty months. Near the cardiac end, in relation to the lesser curvature, an ulcer which measures one-half cm. in diameter, cup-shaped with slightly indurated edges. Lobar pneumonia.

J. Friedenwald (33) in his series of 1000 cases had two cases of gastric ulcer, both males, under ten years of age. Average duration of the symptoms, half a year; no hæmorrhage. No more detailed description of the cases given.

J. N. Hall and T. H. Hawkins (34) report one case, female infant, sixty-seven hours old. Within two hours after birth, fluids regurgitated from stomach, very acid. Much vomiting during first four days, black with bright red blood several times. Stools tarry from the first. Treatment, soda bicarbonate and bismuth, lime water in milk, adrenalin chloride on occurrence of bleeding. No hæmorrhage after sixth day, and recovery apparently complete. The authors consider the symptoms were clearly those of gastric ulcer.

V. Immerwol (35) reports one case, a girl, age five years. Illness began two weeks before admission to hospital, with swelling of the abdomen. Then the face and feet began to swell, and this swelling gradually extended over the whole body. Later fever, diarrhœa, headache, and vomiting appeared. The vomitus in the last few days was dark in color and contained blood. Coma and death. Autopsy showed a dark fluid in the stomach and four ulcers on the posterior wall. The largest ulcer had sharp edges and had destroyed the mucous membrane only. The other three smaller ulcers were more superficial, with slight hæmorrhagic erosions. Kidneys showed lesions of acute nephritis.

W. L. Johnson (36) reports one case, female, age five years. Pain in stomach, especially after eating, for ten months, sometimes followed by vomiting; blood vomited a few times. Tenderness on pressure at pit of stomach. On careful diet, little improvement, followed by an acute attack with considerable blood vomited. Recovery with rest and very little food, diet carefully regulated. Tubercular tendency in patient, but no indication that ulcer is of tubercular origin.

T. G. S. Leary (37) had one case, girl, age seven. Digestive troubles with pain a few hours after meals, sometimes vomiting and nervous irritability. Sudden attack of vomiting blood, tarry stools passed. Treatment, rest in bed, rectal feeding for three days, careful diet. Calomel and soda bicarbonate given occasionally, also Blaud's pill. Recovery; no recurrence in several months.

J. R. Lincoln (38) reported one case, girl, when a few hours old was very uneasy and in first twenty-four hours vomited bright red blood The second day vomited blood several times and for several weeks cried almost all of the time and did not take food readily. Satisfactory food found and recovery after the second month.

B. Morris and M. Feldman (39) report one case. Male child two days old, vomited blood, attacks of vomiting provoked by feeding. Stools also contained blood. Treated with soda bicarbonate, bismuth, and calcium chloride. Cured. The authors believe this to be a case of gastric ulcer causing hæmatemesis and melæna.

W. O. Nisbet (40) reports three cases.

1. Age eight years, sex not stated. Impaired digestion for two years, with several attacks of pain, nausea, and vomiting. Before presented for treatment had vomited blood. Treatment, rest and careful diet, bismuth. Cure.

2. Male, age eight years. For eighteen months attacks of pain, epigastric tenderness, vomiting. Just previous to beginning treatment vomited blood. Treatment as above. Cure.

3. Female, age seven. Pain and acid eructations after meals for about three months. Two acute attacks of pain, nausea, and vomiting. In the last attack, considerable blood vomited. Death followed administration of purgative by attendant, probably due to perforation.

J. P. Parkinson (41) reports one case, male child, age two years and two months. Had suffered from gastric symptoms, occasional vomiting and slight fever for ten days, then suddenly vomited blood and collapsed. Death. Autopsy showed peritonitis and an ulcer near the center of the posterior wall of the stomach, punched out appearance, slightly thickened edges, with perforation at the base. Another small ulcer near by.

E. Parmentier and A. Lasnier (42) report one case. Female, age two and one-half years. At the age of four periodic attacks of epigastric pain and vomiting began, which persisted and became more frequent. A month before entering the hospital she vomited blood several times, constipation, with black stools. Retardation of growth and development. Treatment, rest in bed, with liquid diet. Improvement, gain in weight, cessation of vomiting. After nine months left hospital cured.

Verliac (43) reports case of a male fourteen years old. Digestive troubles for two years, pain, vomiting, and constipation. Attacks of pain and vomiting became very severe, bloody stools several times, but no blood in the vomitus until just before death. Autopsy showed a perforated ulcer on the posterior wall near the cardia, and four other ulcerations, three in the lesser, and one in the greater curvature.

G. K. Paterson (9) One case. Boy, age twelve years and eight months. Illness began with pain in the epigastric region, continued for seven days, then a severe attack of pain in the abdomen with pain in the left shoulder also. Vomiting and symptoms of peritonitis. Operation. Perforated gastric ulcer found on the anterior wall of the stomach about two inches from the middle of the lesser curvature. Peritoneum washed out, drainage. Lung complications.

Also cites the following case reported by Barthaz and Sanné (44). Female, thirteen years old. Dyspeptic symptoms and vomiting. Death from perforation of an ulcer on the lesser curvature of the stomach.

J. Reichelt (45) reports one case, boy, age eight years. For some years vomiting and constipation. For a year a burning pain in the stomach and vomiting after eating. Emaciation. Death after repeated severe attacks of pain and vomiting. Autopsy showed an ulcer with sharp edges in the stomach, 1 cm. above the pylorus in the lesser curvature, perforated. A second ulcer on the posterior wall at the pylorus, base formed by adherent head of the pancreas.

J. A. Robinson (46) reports one case, male, age fourteen. Ill for about one year. Pain after eating, vomiting of mucus and blood, vomiting becoming more and more frequent and the patient becoming anæmic and emaciated. Rest and dietetic treatment. Temporary improvement, but after eating solid food on one occasion vomited bright red blood. After that, progressive failure in spite of careful treatment and rectal feeding. Death. Autopsy showed ulcer at the pylorus. The lining of the stomach was fibrous tissue, the stomach was contracted and the pylorus was constricted.

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# POST-OPERATIVE PLEURISY WITH EFFUSION AND EMPYEMA

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PLEURISY with effusion and empyema may complicate any infection, and, as a general rule, their incidence varies directly as the severity of the infection. There is, however, a definite group of cases in which the complication occurs after infective processes in the upper abdomen. That the infection in the abdomen may be, and usually is, the cause of the pleural effusion — the infection often, if not always, extending either through the lymph-channels or by direct tissue continuity — is apparently not sufficiently well recognized.

Many of the textbooks make little note of the coincidence of abdominal and pleural infection, merely stating that pleurisy with effusion and empyema may complicate infection in any part of the body. On the other hand, Gee and Harder [1] emphasize the association of the two conditions and insist that "empyema on the right side should always arouse suspicion of a subphrenic abscess or a gastric or duodenal ulcer." It was this statement, together with a recent fatal case of post-operative empyema seen by the writer, which led to the study of the records of the Presbyterian Hospital in order to determine the incidence and comparative severity of these complications.

To quote further from Gee and Harder, "pleurisy is often secondary to inflammation beneath the diaphragm, and may occur either with or without the formation of subphrenic abscess. The primary disease may remain latent or may yield only insignificant symptoms. Pleuritic effusion following abdominal infections is more often purulent than serous." They give as the chief abdominal conditions which deserve mention (in the order of their frequency) the following:

(*a*) Gastric and duodenal ulcers.
(*b*) Hepatic abscess.
(*c*) Splenic infarct.
(*d*) Appendix abscess.
(*e*) After operations upon the stomach and intestines.

*Incidence.* During the period studied there were 13,013 operations. Following these operations, dry pleurisy occurred 45 times; pleurisy with serous effusion, 14 times; and empyema, 6 times. Some of the more important operations and the case incidence were as follows:

| Operation upon | Total cases | Serous effusion | Empyema |
|---|---|---|---|
| Appendix | 2766 | 5 cases | 1 case |
| Stomach and duodenum | 159 | 0 cases | 2 cases |
| Intestines (except rectum) | 187 | 1 case | 1 case |
| Gall-bladder and ducts | 288 | 2 cases | 0 cases |
| Liver abscess | 23 | 0 cases | 1 case |

In the twenty cases upon which this record is based, eighteen followed acute abdominal infections and two followed operations upon other parts of the body.[2] Six cases of empyema followed laparotomy for infective processes in the abdomen. In four cases empyema and subphrenic abscess were associated. Bibergeil [3], in 1905, in an analysis of 3909 abdominal operations, found pleurisy with effusion in 16 cases and empyema in 14 cases. According to his statistics, complications referable to the respiratory system are expected after 7.2 per cent of all abdominal operations; and ten per cent of these respiratory complications are pleural effusions, either serous or purulent. Empyema complicated one laparotomy in every three hundred. Unfortunately, the figures for the total laparotomies during the period under consideration are not available, but the incidence in America would probably be considerably lower than Bibergeil found in Germany. This is possibly accounted for by the fact that a large percentage of the operative cases in Germany are so-called "pus cases." In other words, the acute appendix and ruptured duodenal ulcer are not seen at as early a stage in the foreign hospitals as is the case here.

Of the cases of perforated gastric and

[1] Gee and Harder. Albutt and Rolleston's System of Medicine, 1910, v, 535.

[2] In the preparation of this paper, cases of suppurative pleurisy following operations on the thorax were not included in the report.

[3] Bibergeil: Über Lungencomplicationen nach Bauchoperationen. Arch. f. klin. Chir, 1905, lxxviii, 339.

duodenal ulcer, two were associated with subphrenic abscess and empyema. That this relationship is a definite one, and that the presence of any one of the triad should arouse suspicion of one or both of the others, is shown by the report of the following case, which, while not strictly post-operative empyema (and consequently not included in the table of cases), is typical of the condition under consideration.

D. K., age 44. Appendix removed in another hospital ten months before. Condition of appendix unknown.

February 23. Sudden onset of abdominal pain referred to right hypochondrium; no vomiting; marked distention.

February 26. Right chest tapped; 50 ccm. slightly turbid serum; extreme tympanites.

March 2. Five hundred ccm. bloody serum from right chest.

March 12. Pneumothorax definite. Gradually increasing fluid in right chest; marked distention in right hypochondrium. Exploration of chest shows fetid pus. Admitted to hospital. Temperature 100°; pulse 120; respiration 60. Thoracotomy allows discharge of larger amount of fetid pus. Smears and cultures show streptococci, staphylococci, and colon bacilli.

March 16. There was slight improvement after operation. Temperature not above 101°; pulse, 120 to 140; respiration labored. Air hunger developed on fourth day after operation, and patient gradually became weaker and died to-day.

*Autopsy.* Shows old appendix stump and lower abdomen normal in appearance. In the right quadrant there is a large abscess between the right lobe of the liver and the diaphragm. There is a duodenal ulcer which is adherent to the liver and which shows a perforation into the subphrenic abscess cavity.

*Diagnosis.* Duodenal ulcer; subphrenic abscess; empyema.

This patient was seen by several consultants who felt that the main difficulty was above the diaphragm. The course of events must have been: Duodenal ulcer; perforation; subphrenic abscess; empyema.

This route is probably the usual one following an abdominal operation, although there is no doubt that in a few cases the empyema may occur without abscess formation beneath the diaphragm.

*Age and sex.* All the cases occurred in adults. The youngest patient was 23, and the oldest 72. Five cases occurred in the third decade and eight in the fourth. There were only six cases in patients 40 or older. Sex apparently had little influence, twelve cases occurring in women and eight in men. This difference in a small series is not significant.

| Case | Post-operative | | Pleural Effusion | | |
|---|---|---|---|---|---|
| | Temp. | Duration | Onset | Temp. | Duration |
| 1 | 100.2 | 5 days | 9th day | 101.0 | 6 days |
| 2 | 102.2 | 4 days | 8th day | 101.0 | 5 days |
| 3 | 104.0 | 5 days | 21st day | 101.2 | 4 days |
| 4 | 104.0 | Cont. | 17th day | 104.0 | 42+ days |
| 5 | 102.0 | 6 days | 7th day | 102.0 | 8 days |
| 6 | 104.0 | 15 days | 17th day | 103.0 | 8 days |
| 7 | 101.0 | 4 days | 11th day | 100.8 | 3 days |
| 8 | 103.0 | Cont. | 17th day | 102.0 | 9 days |
| 9 | 102.0 | 5 days | 7th day | 102.5 | 29 days |
| 10 | 102.4 | Cont. | 4th day | 102.0 | Died |
| 11 | 103.2 | Cont. | Ante-op. | 103.0 | 36 days |
| 12 | 105.0 | Cont. | 13th day | 102.5 | 35 days |
| 13 | 103.0 | 7 days | 12th day | 103.0 | 16 days |
| 14 | 102.2 | Cont. | 18th day | 100.5 | 23 days |

Explanation of table: *Case* refers to the number given each case and is the same number used in large table. *Temperature* refers in each case to the highest temperature. *Duration* refers in each case to the duration of the fever. *Onset* refers to the day after operation.

For convenience, the two types of effusion may be discussed separately, although it should be emphasized that the distinction is not a definite one, some cases which begin as a serous exudate going on to suppuration.

*Pleurisy with serous exudate.* Fourteen cases are found under this heading, six of which were mild, with signs of only a moderate amount of fluid. Ten cases followed laparotomy, in eight of which the operation was performed for acute suppurative abdominal conditions associated with local or general peritonitis. Two cases (Cases 5 and 7) were persumably "clean cases," but one of these (Case 7) had a post-operative temperature which lasted fifteen days, and which was as high as 103° at times. One case followed nephrotomy for nephrolithiasis, with infection and abdominal symptoms. The other three were cases in which there was apparently little or no infection and no abdominal symptoms.

From these facts, it is apparent that pleurisy with effusion following operation is most common after acute abdominal conditions associated with peritonitis, but that it may occur after other operations and after those in which there are no signs of peritonitis.

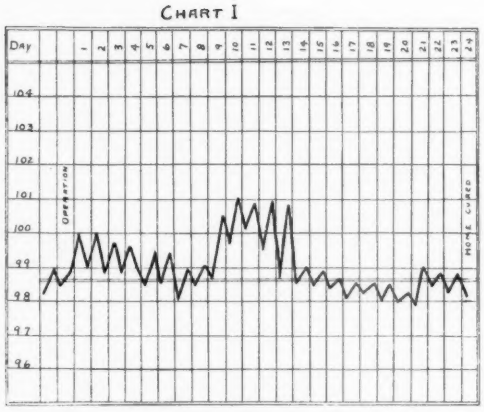


Chart I. Showing mild febrile reaction due to pleurisy with effusion following operation. This case did not require aspiration.

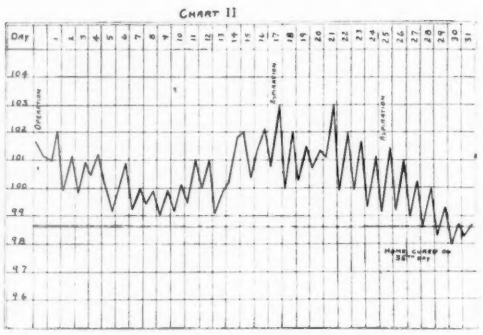


Chart II. Showing moderately severe reaction following pleurisy with effusion. Case required two aspirations and ended in recovery.

The relation of tuberculosis to this condition is no clearer than it is in so-called idiopathic pleurisy. In the absence of autopsy reports, it is hard to prove that there was no tuberculosis present; but, clinically, there were no signs of it, except in two cases, and even in these the signs were very indefinite.

If the pleurisy in these cases is due to the same infective agent as the original disease, it would follow that in most cases the post-operative temperature and the temperature of the pleurisy would be either continuous or one would follow the other with only a short interval of normal temperature. This relation is shown in the table on preceding page.

From the study of this table, we see that in nine cases temperature due to the pleurisy was either continuous with post-operative temperature or occurred after a lapse of less than forty-eight hours. In five cases temperature was normal for a considerable period before the onset of the pleurisy. Of these cases, four were very mild (average duration four and one-half days) and the fifth was only moderately severe (duration sixteen days). In six cases the pleurisy occurred without any period of normal temperature (of these, one died), the average duration of temperature due to the pleurisy being twenty-nine days.

The symptoms of post-operative pleurisy were those of pleurisy with effusion from whatever cause. Pain usually occurred in the chest affected, and it often preceded the fever by one or two days. In some cases, however, pain was absent and the rise in temperature was the first indication of a complication. Fever was always present ranging from 100.8° in the mild cases, to 104° or higher in the severer cases; it was usually the remittent type. In every case, even in those in which the temperature was continuous, there was a distinct rise of temperature with the onset of the pleurisy. The accompanying charts illustrate the temperature variations in a mild case, and in a moderately severe case of pleural effusion following operation, both ending in recovery. As a general rule, this type of pleurisy occurs most often on the right side, indicating that the inflammation spreads by direct extension. In two cases the pleurisy was left-sided, and in both the original focus was a lesion in the left half of the abdomen.

The leucocyte count in uncomplicated post-operative pleurisy with effusion is usually moderately increased, and there is often a slight increase in the polynuclear cells. The average count in uncomplicated cases was 13,800 with 73 per cent polynuclear cells.

The treatment of the milder cases should be expectant only. If the signs of fluid are marked and persistent, the chest should be aspirated and the operation repeated as may be necessary. On theoretical grounds, hexamethylenamine should be given in large doses for its antiseptic effect on the fluid present. In cases where the culture of the

fluid shows bacteria present, Murphy's plan of injecting 2 per cent formaldehyde in glycerine should be carried out. The prognosis of pleurisy with effusion is fairly good. Of fourteen cases, one died, one was lost sight of while the temperature was still 101°, and the remainder recovered. Six cases recovered without any special treatment and the remaining six were aspirated from one to three times. The duration of the illness is always uncertain, the time of convalescence being considerably increased because of the complication. One case left the hospital on the eighteenth day, but the average stay in the hospital was much longer (thirty-five days); and one patient (Case 4), who refused aspiration, still had a daily temperature of 101° when she left the hospital, fifty-nine days after her operation.

TABLE OF CASES OF POST-OPERATIVE PLEURISY WITH EFFUSION

CASE 1. Male, age 55. Operation, excision of hæmorrhoids; pleural effusion; right side. Day of onset, 9; temperature, 101°. Operation, none; result, recovered.

CASE 2. Male, age 58. Operation, amputation of thigh; pleural effusion; right side. Day of onset, 8; temperature, 101°. Operation, none; result, recovered. Remarks, sarcoma of thigh.

CASE 3. Male, age 46. Operation, laparotomy for perisigmoid abscess; pleural effusion; right side. Day of onset, 21; temperature, 101.2°. Operation, none; result, recovered.

CASE 4. Female, age 31. Operation, appendectomy, salpingectomy, drainage; pleural effusion; right side. Day of onset, 17; temperature, 104°. Operation, refused; result, (?). Remarks, diffuse peritonitis; home against advice.

CASE 5. Female, age 28. Operation, appendectomy without drainage for acute appendicitis; pleural effusion; right side. Day of onset, 7; temperature, 102°. Operation, none; result, recovered.

CASE 6. Female, age 30. Operation, laparotomy for ruptured ectopic; pleural effusion; right side. Day of onset, 17; temperature, 103°. Operation, none; result, recovered.

CASE 7. Female, age 30. Operation, repair of lacerated perineum; pleural effusion; right side. Day of onset, 11; temperature, 100.8°. Operation, none; result, recovered. Remarks, tuberculosis (?).

CASE 8. Female, age 24. Operation, appendectomy for appendix abscess; pleural effusion; right side. Day of onset, 17. Operation, aspiration; fluid, serous, sterile; result, recovered. Remarks, fæcal fistula — secondary abscess opened on fourteenth day.

CASE 9. Female, age 57. Operation, cholecystectomy, drainage; pleural effusion; right side. Day of onset, 7; temperature, 102.5°. Operation, aspiration — eight ounces obtained; fluid, serous; result, recovered.

CASE 10. Female, age 72. Cholecystectomy, drainage; pleural effusion; right side. Day of onset, 4; temperature, 102°. Operation, aspiration; fluid, serous. Remarks, died on the twenty-second day — no autopsy.

CASE 11. Male, age 35. Operation, laparotomy for pancreatic abscess; pleural effusion; left side. Day of onset, ante-operation; temperature, 103°. Operation, aspiration on fourth day and twenty-third day, fluid sterile; result, recovered. Remarks, signs of fluid on admission, sixteen ounces clear fluid on fourth day, and eighteen ounces bloody fluid on twenty-third day.

CASE 12. Male, age 37. Operation, left nephrotomy for stone; pleural effusion; left side. Day of onset, 13; temperature, 102.5°. Operation, aspiration, twentieth, twenty-eighth, and thirty-ninth day, a total of fifty-four ounces; fluid, serous, sterile; result, recovered. Remarks, few râles at left base on discharge.

CASE 13. Male, age 23. Operation, appendectomy, drainage; pleural effusion; right side. Day of onset, 12; temperature, 103°. Operation, aspiration of fifteen ounces on twenty-second day and two ounces on the twenty-eighth day; fluid, serous; result, recovered.

CASE 14. Female, age 29. Operation, appendectomy for acute appendicitis; pleural effusion; right side. Day of onset, 18; temperature, 100.5°. Operation, aspiration of ten ounces on twenty-fourth day and twenty-two ounces on thirty-seventh day; fluid, serous; result, recovered. Remarks, cultures of fluid showed large spore-bearing bacilli.

POST-OPERATIVE EMPYEMA

In this condition we have to deal with an extremely serious, and an exceedingly fatal, condition. I wish to call attention, at the beginning, to the fact that in six cases of empyema following operation *there was not a single recovery*. I have incomplete records of several other cases, occurring in private practice and in other hospitals, the most salient characteristic of which is the fatal issue. There can be no doubt that cases have occurred with recovery, but the cases cited here are convincing evidence of an extremely high mortality. At the outset I want to emphasize the fact that these cases are not merely terminal infections, but in most cases gave symptoms many days before death, and, as a rule, the pleural suppuration seemed the main foci of infection and the

direct cause of death. The cause of the pleural infection is easily seen by a glance at the table. Every case followed laparotomy, and in each case the lesion was associated with peritonitis, either local or general. In four cases the original lesion was situated in the upper half of the abdomen, and in two of these patients the infection started as a perforated ulcer, either gastric or duodenal.

From the above it is apparent that empyema is common following perforation, and that signs in the right chest following the repair of a perforated ulcer should always lead to the immediate exploration of the pleural cavity; and, *vice versa*, in cases of idiopathic empyema in adults, a most careful examination of the abdomen should be made to exclude the possibility of infection beneath the diaphragm. I have already cited a case in which the pleural condition was mistakenly considered the primary lesion; and in the table (Case 20) there is an example of a case in which the diagnosis of pyopneumothorax was not made during life. In the presence of either of these two conditions the possibility of their coexistence always demands serious consideration.

The third member of the group, subphrenic abscess, apparently has a definite relation to the others also, and its occurrence should always lead to the suspicion of either, or both, the others. In the six cases under consideration, subphrenic abscess was present in four, absent in one, and doubtful in one; in other words, if one may judge from six cases, we may expect to find subphrenic abscess in two-thirds of the cases of post-operative empyema. In three cases the abscess was demonstrated during life, and in one case (No. 15) there were absolutely no signs referable to the abdomen; yet autopsy revealed a large subphrenic abscess containing almost a pint of foul-smelling pus.

The absence of pain, cough, and other symptoms referable to the chest should be especially noted. It is possible to have an acute empyema, with the accumulation of large quantities of pus in the pleural sac, without any symptom which would direct attention to the chest. On the other hand, general symptoms were always present. The temperature following operation might fall to normal, and then slowly rise again with the progress of the thoracic infection. The usual course is for the temperature to continue, but on a generally lower level, until the onset of the empyema; then, slowly rising again, it often reaches 103° or 104° and continues at about this level, often with septic remissions, until shortly before death, when it usually either reaches 105° to 107° or falls to normal or subnormal. The cases all occurred in adults between 26 and 56, and the majority of these cases were females.

The result of the exploration was especially interesting. In two cases the effusion was apparently purulent from the start; in two other cases the fluid was turbid; and in the fifth case it was reddish amber. This contrasts strikingly with the cases of pleurisy with effusion in which the fluid was always clear straw-color and remained so throughout the course of the disease. Is there a period during which the effusion in these cases is serous, and does it only become purulent after it has become infected? This question cannot be answered, but it seems to me that the statement is justified that. if the exploration of the chest in cases of this type results in a turbid exudate, the process will probably go on to pus formation, and that, furthermore, the presence of a clear, sterile exudate is in most cases favorable to the recovery of the patient.

Cultures of pus from the chest in post-operative empyema usually resulted in a number of different organisms. This in itself points to direct extension of the inflammatory process, for when an organism is carried by the blood to a distant portion of the body it is usually present in pure culture. In one case the examination of the fluid showed many yeast-cells which presumably were spread from the stomach by means of the perforated ulcer and direct extension. Tuberculosis was definitely present in only one case, and in this patient the process was a chronic one and apparently in no way responsible for the fatal issue.

The prognosis is bad; no case recovered. One patient lived ninety-nine days after the first operation and thirty-seven days after thoracotomy had been performed. Two pa-

tients died shortly after operations for the relief of accumulations of pus, and in two cases thoracotomy was not performed. It is difficult, from such a series, to say anything regarding treatment. These patients have already one serious lesion to combat, and it is exactly those cases in which the abdominal lesion is severe that are associated with empyema. However, some patients rally well after the abdominal operation, only to succumb to pleural (and possibly also subdiaphragmatic) infection. Shall the pleura be opened immediately upon the discovery of turbid fluid in the chest, or shall we wait for adhesions to form? I have seen such a case opened early, and the respiratory difficulty from the resulting pneumothorax has seemed to be of more importance than the toxæmia due to the infection. Further study may demonstrate a more satisfactory method of dealing with this condition. The case histories of six cases of post-operative empyema referred to in this paper are given herewith.

CASE 15. B. B., age 31. Patient comes under treatment for "stomach trouble" which she has had for many years. Two days before, there was a sudden sharp abdominal pain and marked prostration. Abdomen showed signs of diffuse peritonitis with shifting dullness in both flanks.

September 18. Median laparotomy showed large amount of free pus in peritoneal cavity. Because of bad condition, cause of inflammation was not searched for, but wound closed with drainage. Examination of pus showed bacillus coli communis and many yeast-cells.

September 24. Drainage has been profuse; temperature irregular between 100° and 103°; signs of dry pleurisy on left side to-day.

September 27. Signs of fluid in left chest; aspiration gives 1060 ccm. slightly turbid yellow fluid.

October 10. Temperature has continued, but has been a little lower. General condition has been unsatisfactory, but better than on admission. Bowels moved by catharsis; only slight discharge from abdominal wound. Thoracotomy; a large amount of brownish pus.

October 23. Some improvement since last operation. Free drainage; a little clear fluid in right chest.

November 1. Condition not so good; cough troublesome; small amount of fluid in right chest.

November 11. Temperature has been a little higher and patient has been growing steadily weaker. There have been no signs in abdomen, no tenderness over liver, or other signs pointing to local accumulation of pus. Patient died suddenly to-day.

*Autopsy.* Perforated gastric ulcer of lesser curvature; large subphrenic abscess; perisplenic abscess; chronic tuberculosis of both apices; empyema; small septic abscess in liver and lung.

CASE 16. M. A., age 26. Patient well until one and a half years ago, when he had fever and chills for several days, and has not felt entirely well at any time since. For two weeks had sticking pains in the right side. Physical examination shows moderate prostration; temperature, 101.5°; pulse, 80. The right upper quadrant seems full with slight bulging of ribs; rigidity and tenderness in same area. X-ray shows liver enlarged downward. Lungs are clear.

January 27. Operation: incision and drainage of liver abscess; culture showed streptococci.

February 1. Septic temperature; only slight discharge from wound.

February 11. Exploratory laparotomy; drainage of perirectal abscess.

February 22. Incision into substance of liver revealed a cavity the size of an egg, containing small amount of pus.

February 28. Only very slight drainage from incision; septic temperature continues; rectal examination and blood cultures negative.

March 20. Twenty-two ounces of turbid fluid aspirated from right chest; temperature higher — 103.8°.

March 28. Aspiration of chest, 28 ounces; general condition much worse.

March 29. Thoracotomy, with escape of large amount of turbid fluid; exploration of subphrenic space shows large amount of pus.

May 6. Condition has been about the same. To-day he developed acute abdominal symptoms and abscess was found in the left upper quadrant. Patient did not rally after the operation.

*Diagnosis.* Abscess of liver; subphrenic abscess; empyema and perirectal abscess.

CASE 17. J. D., age 35. Onset of illness four months before, with vomiting. Dull pain in left side and left flank for three months; worse for past week. Fever and chills at irregular intervals for last two months.

March 31. *Examination.* Shows prominence of left upper abdomen, with rigidity and tenderness. *Operation.* A large subphrenic abscess; opened and drained. Cavity appears to be chiefly on left side.

April 20. Seven ounces of reddish amber fluid aspirated from left chest; temperature continues.

May 14. Temperature has been high — 102° to 105°, but recently it has been about 102°. Chest opened to-day under cocaine.

May 20. Patient has been growing weaker; died suddenly to-day.

*Diagnosis.* Subphrenic abscess; empyema.

CASE 18. L. L., age 38. Patient gives history of acute illness lasting only four days. Acute abdominal pain and tenderness, associated with vomiting.

October 17. *Physical examination.* Shows

marked prostration; abdomen generally distended with tenderness and rigidity over all, but a little more marked in the right lower quadrant. *Operation.* Shows gangrenous appendix with a diffuse purulent exudate. Appendectomy and drainage.

November 13. Temperature about 102° since operation; condition at first was very bad, but recently a little better. Fæcal fistula developed after operation, but stopped on seventeenth day.

November 14. Chest explored to-day and about 50 ccm. foul-smelling pus removed.

November 15. Died suddenly to-day.

*Diagnosis.* Acute suppurative appendicitis; acute suppurative general peritonitis; empyema.

CASE 19. Mrs. G., age 56. For two years has had indefinite gastric symptoms; burning pain in epigastrium after eating. Acute onset on day of admission, with violent abdominal pain and vomiting. General abdominal tenderness and rigidity of whole abdomen, most marked in right upper quadrant; dullness in right flank.

December 11. *Operation* on day of onset showed perforated duodenal ulcer with stomach contents free in abdomen. Ulcer was closed, and subphrenic space and pelvis were irrigated; drainage to pelvis and subhepatic space.

December 16. Temperature remained below 100° for first four days; is a little higher to-day. Aspiration of chest to-day, and 170 ccm. of thick yellow pus removed.

December 17. Thoracotomy, with removal of about 15 ounces of thick yellow pus.

December 31. Temperature has been rising; at times 102°. Free discharge from chest; lower wound practically healed.

January 3d. *Operation* showed large subphrenic abscess with about one pint of pus between the liver and diaphragm. Following operation patient's condition grew gradually worse, and she died twenty-four hours later.

*Diagnosis.* Duodenal ulcer; peritonitis; empyema; subphrenic abscess.

CASE 20. A. M., age 40. For two weeks before admission has had attacks of dizziness and vomiting; constipation marked; no fever or chills. *Examination.* Shows stricture of rectum about 3 inches from anus which admits tip of finger; heart and lungs negative. *Operation,* October 12, colostomy. Condition after operation poor; temperature rose to 102° after operation, but fell to normal in three days.

November 24. Patient has vomited frequently since operation and evidently retains very little food; is kept awake at night by hiccoughs. Temperature has been normal.

December 15. Temperature has reached 102° or 103° daily. Patient vomiting profusely; condition very bad; pulse weaker. No complaint of pain in right chest; slight cough with profuse expectoration. Died suddenly to-day.

*Autopsy.* Stricture of rectum; pyopneumothorax, right; (there were no signs of peritonitis or of subphrenic abscess).

TABLE OF CASES OF POST-OPERATIVE EMPYEMA

CASE 15. Female, age 31. Operation, laparotomy for diffuse peritonitis; pleural effusion; left and right sides. Day of onset, 6; temperature, 103°. Operation, aspiration on ninth day, thoracotomy on twenty-second day; fluid, turbid pus; result, died. Remarks, perforated gastric ulcer, subphrenic abscess, tuberculosis; died fifty-third day; autopsy.

CASE 16. Male, age 26. Operation, incision and drainage of liver abscess; pleural effusion; right side. Day of onset, 44; temperature, 103.8°. Operation, aspiration of 22 ounces fifty-third day, 28 ounces sixty-first day, and thoracotomy on sixty-second day; fluid, turbid pus; result, died. Remarks, subphrenic abscess and perirectal abscess; died ninety-ninth day.

CASE 17. Male, age 35. Operation, incision and drainage of subphrenic abscess; pleural effusion; left side. Day of onset, 18; temperature, 105°. Operation, aspiration on twenty-first day, thoracotomy on forty-fifth day; fluid, reddish amber pus; result, died. Remarks, subphrenic abscess, left; died fifty-first day.

CASE 18. Female, age 38. Operation, appendectomy for abscess; pleural effusion; right side. Day of onset, 25; temperature, 102°. Operation, aspiration of two ounces on twenty-eighth day; fluid, pus; result, died. Remarks, fæcal fistula; died twenty-ninth day — no autopsy.

CASE 19. Female, age 56. Operation, laparotomy for perforated duodenal ulcer; pleural effusion; right side. Day of onset, 6; temperature, 102°. Operation, aspiration of six ounces sixth day, thoracotomy on seventh day; fluid, pus, mixed infection; result, died. Remarks, subphrenic abscess opened on the twenty-fourth day; died on the twenty-fifth day.

CASE 20. Female, age 40. Operation, colostomy for intestinal obstruction; pleural effusion; right side. Day of onset, (?); temperature, 103°. Operation, none; result, died. Remarks, autopsy showed pyopneumothorax and benign stricture of rectum; died twenty-first day.

CONCLUSIONS

From the study of the above cases we are justified in concluding that —

1. Pleural effusion is not of uncommon occurrence after operations, and may occur at any time, but is most often seen before or shortly after the subsidence of the post-operative temperature.

2. It is most frequently seen after septic abdominal conditions, and is usually on the right side.

3. A clear serous exudate in right chest is not necessarily a serious complication, such cases usually going on to recovery.

4. In so far as they refer to post-operative conditions, Gee and Harder's statement that "pleural effusion following abdominal infection is more often purulent than serous" is not borne out by case records.

5. There is a distinct clinical type of empyema which may complicate abdominal infections either before or after operation, and the case mortality of this type is very high.

6. The relationship which exists between perforated gastric ulcer, subphrenic abscess, and empyema is exceedingly close; and the occurrence of one of these conditions, without apparent cause, should lead to a suspicion of one or both of the others.

7. A turbid or purulent effusion occurring in the right chest, following laparotomy, requires immediate drainage, and should lead at once to the exploration of the subphrenic space.

NOTE.— I wish to acknowledge herewith my indebtedness to the attending staff of the Presbyterian Hospital for their courtesy in granting permission to study and report these cases.

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# INTESTINAL OBSTRUCTION DUE TO CANCER OF THE COLON

## WITH A NOTE ON THE OPERATIVE TREATMENT OF THIS CONDITION

BY ALEXIUS McGLANNAN, M. D., BALTIMORE

INTESTINAL obstruction due to cancer of the colon may be either acute or chronic, occurring as the symptom of onset of the malignant disease, or as a development during its course. In addition to these forms there is the post-operative acute obstruction, which may occur after removal of the tumor or an operation designed for palliation.

In the series of 98 cases studied for this paper, 61 have an obstruction of some sort in their pre-operative histories. In 33 the tumor was found to be operable, and 13 patients were cured. An obstruction, therefore, is a little more likely to occur in the course of a curable than an incurable tumor and has this value in prognosis.

The position of the tumor in each of the groups is shown in the table.

An acute obstruction occurred as the symptom of onset in ten cases. Seven were operable tumors, of which number four were cured and three died, one from the toxæmia of obstruction, one from embolism, and one from a post-operative obstruction. Three patients had inoperable tumors, one of whom is still living two years after the removal of the tumor and the accessible metastatic glands.

Occurring during the course of the disease, an acute obstruction is found in 20 cases. Of these, fourteen were operable tumors: four are cured; five died from the toxæmia of the obstruction; one from an acute dilatation of the stomach coming on four days after the complete removal of the tumor; two from shock; one from embolism seventy days after the removal of the tumor; and one from peritonitis nine days after the resection and anastomosis.

Chronic obstruction as the initial symptom

TABLE SHOWING ULTIMATE RESULTS ACCORDING TO THE LOCATION OF THE TUMOR.

| Location of tumor | Obstructive Group | | | Non-obstructive Group | | |
|---|---|---|---|---|---|---|
| | Cured | Inoperable Living | Dead | Cured | Inoperable Living | Dead |
| Cæcum | 5 | 2 | 10 | 5 | 2 | 8 |
| Appendix | | | | 1 | 1 | |
| Ascending and Hepatic | 1 | 1 | 7 | 0 | 0 | 8 |
| Transverse | 2 | 0 | 2 | 0 | 0 | 1 |
| Splenic and Descending | 1 | 1 | 6 | 0 | 1 | 3 |
| Sigmoid | 4 | 3 | 15 | 0 | 2 | 3 |
| Unknown | | | 1 | | 1 | |
| Multiple | | | | | | 1 |
| Totals | 13 | 7 | 41 | 6 | 7 | 24 |

occurred in ten cases. Four are cured, one patient whose tumor was felt to be inoperable is living one and one-half years after a short-circuiting operation. None were operated upon because of this symptom alone, but three of the cured cases came to operation on account of an acute obstruction developing during the course of the disease. Of the remaining cases six were operated upon on account of the persistent obstruction, or an alternating chronic obstruction and diarrhœa; three had operable tumors, and two died from post-operative obstruction. In one case the operation was the incision of an abscess of the lumbar region, due to infection of the muscles by the perforation of an infiltrating tumor.

Chronic obstruction during the course of the disease is noted in twenty-seven cases. Twenty-two patients were operated upon on account of the persistent chronic obstruction either with or without some corroborative symptoms. Five patients are cured, and four in whom the tumor was found irremovable are living. Two of these are short-circuited, one has a colostomy, while the fourth patient was closed after a simple exploration.

Among the fatal cases, eight patients had operable tumors: four died of post-operative obstruction, one of embolism, one of acute dilatation of the stomach, one of pneumonia, and in one case the history is incomplete and the cause of death is not given.

Of the thirty-seven unobstructed cases, six are cured. Three others had operable tumors, but died as an immediate result of the operation of peritonitis resulting from a leaking suture. Seven patients who had irremovable tumors at the time of operation are living. In two of these a short-circuiting was done; four were simply explored; in one a colostomy was performed. Sixteen are dead as a direct result of the inoperable tumor.

In both series we have patients whose tumors were operable, but who died as a result of some accident or complication following the operation, and a second group in which the patients are living, although the tumor was irremovable at the time of the operation. Omitting these cases from the series, we have thirty-two in which obstructions occurred, of whom thirteen recovered (forty per cent), and twenty-two non-obstructive, of whom six recovered (twenty-seven per cent). If we add to the cured cases in the first group those patients who died from the toxæmia of obstruction because of delay in operating, and who, therefore, might reasonably have been expected to recover had they been relieved earlier, we add six cases and have sixty per cent possible cures.

Recognition of obstruction as a symptom of cancer of the colon, and prompt operation for the relief of this symptom, at least, is of the utmost importance in advancing the possibility of cure for the patient.

Biologically, carcinoma of the colon is generally one of low-grade malignancy. The tumor grows slowly and has a strong tendency to be circumscribed in the extent of its invasion of the bowel. Metastases develop slowly and are seldom present until after the tumor has given fairly distinct warnings of its presence. These warnings are obstruction, acute or chronic; alternating diarrhœa and constipation; blood and mucus in the stools; progressive loss of weight and a sense of stiffness or spasm in the bowels. The obstruction is generally an obstipation rather than a strangulation, for which reason these patients often show visible peristalsis; visible or palpable spastic coil and other symptoms of the compensatory stage of obstruction, lasting for many days with little or no toxæmia.

Protective adhesions may cause volvolus, or intussusception, or an acute obstruction by a band, but these strangulation forms are unusual.

The gross pathology shows the tumor involving the bowel as a nodular mass, as a tubular or annular infiltration, or what is most frequent, a combination of these forms. The tumor may begin as a polypus. In the beginning there is no alteration of the surface of the mucus membrane and no diverticulum or ulcer is found.

In the growth of the tumor the malignant cells advance either by expansion or by infiltration. In the former case the epithelial cells form a compact mass which is definitely circumscribed by a fibrous reaction on the part of the invaded connective tissue. From

this barrier fibrous trabeculæ extend into the epithelial masses, forming a more or less dense stroma. The mass of epithelial cells permeates the coats of the bowel as a globular mass with an encroachment on the lumen until it reaches the peritoneum, when the connective-tissue reaction becomes manifest in the formation of adhesions. It is at this point that the tumor-cells enter the lymphatics and metastasis to glands and distant organs occurs. The extent of adhesions, therefore, and particularly the relation of this extent to the size of the tumor, becomes a measure of the relative malignancy of the tumor.

Extension by infiltration is the more frequent method of growth, and may be either intra- or interglandular. The former is relatively rare, and in this variety the proliferating cells extend over or under the surface of the mucous membrane, or through the submucous coat. In morphology and staining characteristics the cells are changed very slightly from the normal.

Interglandular infiltration is the common form of growth, the extension occurring through the lymph-vessels. These vessels tend to form four groups: those of the mucous, the submucous, the muscular and the subperitoneal coats. The mucosa group begins high up in the spaces of the mucous membrane and coming down through the periglandular reach the subglandular lymphatics, situated on the medial side of the muscularis mucosa. These subglandular vessels are united to those of the submucosa by wide channels, and these in turn go in a perpendicular direction to join the muscular and subperitoneal groups.

The infiltrating cancer-cells, therefore, may grow horizontally along the peri- and subglandular lymphatics forming a tubular mass, or out in the perpendicular channels to reach the submucous groups, in which event a narrow annular mass will be formed. Very often a combination of both forms occurs, and frequently the expansive form of extension is also present, so that a combination of the nodular, tubular, and annular tumor results.

Having reached the subperitoneal lymphatics, the malignant cells next stimulate the connective-tissue reaction in their vicinity with resulting adhesions between the tumor and surrounding viscera and the abdominal walls.

In adenocarcinoma, the variety most often associated with obstruction, the mass is hard, elastic, and nodular with occasional areas of softening from necrosis. On opening the bowel the tumor is quite definitely separated from the healthy mucous membrane by a wiry, hard edge, raised above its surface. Below the tumor the colon is normal or its wall is shrunken. Above, the wall is changed to a greater or less extent depending on the degree and duration of the stasis produced by the tumor. This change varies from a simple hypertrophy of the muscularis to an extreme dilatation with paralyzed, flabby, œdematous and friable walls. The disturbed nutrition of the walls with the bacterial decomposition of the intestinal contents soon gives rise to a severe toxæmia which becomes fatal unless promptly relieved by operation.

Œdema of the mucous membrane above the tumor is almost constantly present, and a rapid intensification of this œdema is the commonest cause of the acute obstruction occurring in the clinical course of these tumors.

Ulceration is common: a superficial shallow ulcer is most frequent, but the necrosis may form a perforating ulcer causing local or general peritonitis; a perforation into another viscus (for example, a pathological anastomosis); or an intermuscular abscess.

In carcinoma solidum, the late form of tumor, the mass is hard, often showing fine lobulations and ulceration, usually with perforation. Some stenosis will be present with its compensatory hypertrophy or resulting dilatation.

Vesicles of clear, viscid, gelatinous material shining out in various parts of the rather soft tumor characterize the gelatinous or colloid form of carcinoma of the colon. The soft masses of peritoneal metastases occurring in this colloid form of carcinoma solidum may be confused with tuberculosis of this membrane.

Histologically, carcinoma of the colon is divided into three varieties, according to the character of the epithelial cells and their arrangement. The third form seems to be the

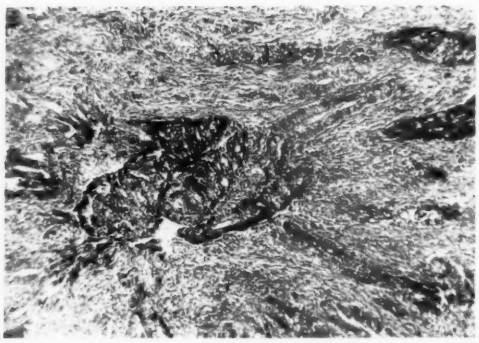

Fig. 1. Carcinoma cylindric-ocellulare. Tumor of splenic flexure. Obstruction recurrent. Photomicrograph by Schapiro.

end-result of the growth of the first two; while the second is apparently a metamorphosis occurring in the first variety when the vigor of the malignant growth of the epithelium is markedly greater than the resistance of the reaction on the part of the connective tissue.

The first variety, adenocarcinoma cylindrico-cellulare, is most frequently found in the obstructive cases (42 of the 61 cases in this series). The tumor-cells are cylindrical epithelium very slightly changed from the normal cells of the mucous membrane. The proliferation begins in the fundus of the glands with a piling up of several rows of cancer-cells, which soon form an atypical glandular mass beneath the basement membrane. A simultaneous connective-tissue reaction forms a protective barrier separating the tumor from the surrounding healthy tissue and sending strands into the epithelial masses, as the stroma. The glandular arrangement is preserved in the extensions of the tumor in the wall of the bowel and is reproduced in the metastases. The latter occur quite late in the disease, in those tumors where the cells retain the cylindrical form.

In certain tumors proliferation of epithelium goes on to form solid tubes rather than take the ordinary glandular form. At the same time the type of cell changes from the cylindrical to a flat polygonal cell, with a large deeply staining nucleus; that is, a cell of the same type as the cuboid cell of the epidermis. The tumor, therefore, is called adenocarcinoma cubocellulare. The connective-tissue reaction is slight and the barrier insignificant. The epithelial cells grow rapidly with abundant mitoses, and, quickly permeating the bowel wall, form widespread metastases to lymph-glands and distant organs. This variety of tumor is more commonly non-obstructive, and has brought about the death of the patient in each of the seventeen cases in which it was present in this series.

The third variety, carcinoma solidum, is the end-product of the local growth of the first two. It is not a measure of the duration of the tumor, but considered in relation to the duration, the presence of this form is rather an indication of the degree of malignancy of the tumor.

The cells are flat, oval, or polygonal, and are found in large solid masses in a scanty fibrous stroma — the medullary or alveolar tumor, or in small epithelial areas in a considerable stroma — the scirrhous or diffuse form.

Metastases to lymph-glands or distant organs are nearly always present with this third variety of tumor and make the prognosis practically hopeless.

Carcinoma gelatinosum. Many of the tumors of all varieties have goblet-cells containing gelatinous or mucoid material with the cylindrical or cuboid ones. A preponderance of the mucoid cells gives the tumor a softer consistency, while its relative malignancy is controlled by the presence or absence of the cuboid cells. In addition to the usual routes of extension, tumors of this type show a marked tendency to spread on the serous coat of the bowel and form diffuse metastases on the peritoneum.

In planning the treatment of the obstructive form of tumor, we must arrange for the relief of the obstruction and combat its toxæmia, should this exist. At the same time the operability of the tumor must be determined and this fact with the method for its removal be kept in mind while arranging for the immediate relief of the obstruction.

The method chosen, therefore, must vary within quite wide limits. For the sake of easy reference I will describe first the findings

at exploration which determine the operable or inoperable nature of the tumor. These are:

*First.* Extensive firm adhesions between the tumor and adjoining loops of intestine, other viscera, and especially between the tumor and the lateral and posterior walls of the abdomen. Adhesion to other loops is not necessarily a sign of inoperability, provided the excision of the tumor and the adherent coil is technically possible. In one case of this series a sigmoid cancer involved a loop of ileum in its growth. The entire mass was removed and the patient is living and well three years after the operation.

*Second.* Metastases to the peritoneum, liver, other portions of the intestine, and to the retroperitoneal glands. The route of metastasis may be indicated in a fairly definite way according to the localization of the tumor. Those of the cæcum give metastases to the mesocolon, stomach, small intestine, and to the supraclavicular glands, but do not involve the liver or pancreas. Tumors of the hepatic flexure reach the liver as well as the stomach and the supraclavicular glands. Sigmoid tumors are especially likely to have metastases to the liver.

*Third.* Involvement of other viscera or the abdominal wall by a direct extension of the tumor.

*Fourth.* Involvement of the great vessels, especially the femorals, by the growth of the tumor.

According to the condition of the patient at the time of operation we may make the following groups:

1. Acute obstruction with toxæmia, no localizing symptoms. That is, a patient who shows only the symptoms of acute obstruction, without a mass, visible or palpable spastic coil, local tenderness or other signs indicating the position of the obstruction. In such cases a midline exploration should be made, best under local anæsthesia, and an immediate enterostomy performed. The position for making this opening will depend largely on the character of the tumor. With an operable tumor it is better to have the enterostomy through a wound in the side of the abdomen opposite the location of the tumor. This

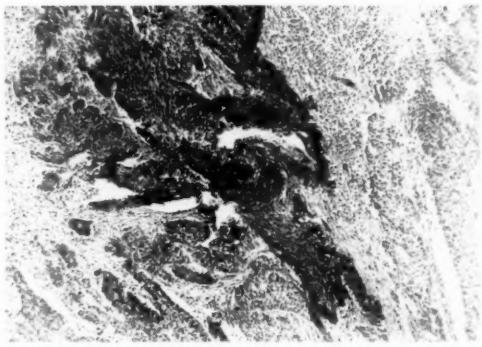

Fig. 2. Carcinoma cubocellulare. Tumor of sigmoid flexure. No obstruction. Photomicrograph by Schapiro.

makes it possible to remove the tumor at a latter date through a clean field not encumbered by adhesions about the enterostomy. Whenever possible the cæcum is the best place for this opening. The bowel should be opened at once, and a tube inserted.

The toxæmia may be combated by subcutaneous salt solution given in large quantity, slowly through one or two small caliber needles, adding adrenalin if the blood-pressure is greatly lowered. The stomach should be washed out and castor oil poured in through the tube after the lavage. When the tumor is situated a distance from the enterostomy,—for example, in the sigmoid with a cæcostomy opening,—the impaction of the colon will continue the toxic symptoms after the small intestine has been emptied. For such cases, warm oil given by the drop method through a catheter into the enterostomy, will soften the masses which will be expelled later through the wound or by the anus. After the obstructive symptoms and the toxæmia have disappeared, the tumor is to be attacked as described under the chronic obstructions.

Should the exploration prove the tumor inoperable, the colon should be opened immediately in the most convenient place for the artificial anus, unless it is felt that a short-circuiting anastomosis around the tumor could be done later. In the latter case the bowel should be opened across the abdomen. This same rule applies when the patient has localizing symptoms in addition to those of acute obstruction.

2. Chronic obstruction. Here there is not the urgent need of relief required by the patients in the first group. Localizing symptoms may be sought for, and one of the most valuable of these is the X-ray picture after the administration of bismuth by enema or by mouth. Having determined the probable seat of the tumor in such a case, the abdomen is opened in the most convenient place for exploration, and one of several methods are then available for the treatment of the tumor.

Operable tumors:

(a) Resection and anastomosis. When the patient is in good physical condition, without toxæmia or anæmia, and the bowel empty, removal of the tumor and immediate restoration of the continuity of the bowel is possible. This operation is the most satisfactory because at a single séance we are able to cure the patient. Unfortunately, few patients come to us in condition for this operation. The lateral anastomosis is the method of choice, and when both segments are of the large intestine, the anastomosis described by Bloodgood[1] should be used. In this method the closed ends are brought side to side, as the thumbs may be approximated and are then anastomosed. The turned-in ends are sutured outside the parietal peritoneum. Leakage, which is most likely to result from imperfect circulation of these ends, then forms a superficial fistula instead of a peritonitis.

Among the operable tumors in this series four patients died of peritonitis from leakage at the site of the anastomosis. The thumb method was not used in any of these fatal cases.

(b) Resection and anastomosis, bringing the open ends of the segments out of the abdomen. Impaction of the bowel above the resection, with subsequent fatal post-operative obstruction from this cause, occurred in one operable case treated by resection and anastomosis. Such a disaster may be avoided, as may also the danger from sloughing of the ends of the segments, by making the anastomosis as usual, but instead of closing the divided ends, bringing them to the skin surface and closing the wound around them. In this way we provide free exit for the bowel contents above the anastomosis as long as this may be required, and having already completed the removal of the tumor and the anastomosis we make the closure of the fistula a simple procedure.

The method has an advantage over that of anastomosis with enterostomy above the suture, in that it drains the lowest portion of the bowel, that in which impaction is most dangerous.

(c) The protrusion operation. This method is especially useful when dealing with anæmic patients in whom relief of obstruction by enterostomy has not improved the general condition. Toxæmia from the tumor continues to depress the nutrition, while the condition of the patient makes an extensive operation impossible and at the same time renders the process of healing less certain. In such cases the surgeon is confronted with the necessity of operating and the dangers of shock and sloughing.

In the protrusion operation the vessels supplying the area to be removed are ligated and the mesentery divided, the tumor with the lymphatic glands is delivered through the abdominal wall, and the peritoneum closed. After forty-eight hours the bowel is divided by the cautery, no anæsthetic being required, and the patient left with a double enterostomy. Later the spur between the loops of the enterostomy is divided by pressure of the enterotribe.

A modification of this protrusion makes the lateral anastomosis before delivering the tumor. After the bowel is divided in this modification, the patient is in the same condition as after the operation (b). The great advantage of the protrusion operation lies in the speed with which it may be performed and the entire freedom from soiling of the peritoneum and from danger on account of imperfect circulation in the ends of the bowel. It has an advantage over the preliminary short-circuiting in that the abdomen is opened but once, and the risk and annoyance of dealing with post-operative adhesions is avoided.

For the irremovable tumor we have two operations:

[1] Tr. Am. Surg. Ass., 1909, xxvii, 340.

1. Short-circuiting; that is, a lateral anastomosis of a loop of bowel above with one below the tumor. In this way a new route is opened for the passage of fæces and the obstruction is overcome. This short-circuiting may be combined with enterostomy above the anastomosis for the relief of toxæmia, or better, with a temporary opening near the tumor in order to give egress to the accumulation immediately above it.

2. Colostomy. In some tumors, especially those of the sigmoid, it is impossible to do a short-circuiting operation. For such patients a colostomy is the only recourse. The bowel may be divided above the tumor and the end brought out of the wound, or the loop may be sutured to the abdominal wall and opened laterally. If the bowel be divided the lower segment is closed and inverted, while the upper one is brought through and under the rectus muscle, much as is the stomach in a Ssbanajew-Frank gastrostomy; or when this is impracticable the segment of colon is twisted around its long axis half a circle and then brought through the muscle.

The after-care of the colostomy patient may add a great deal to his comfort or misery. A dressing that will prevent leakage of fæces and escape of gas is a valuable aid to these patients. Such a dressing is described by W. W. Keen.[1] A dummy truss is the "key to the situation" with this dressing, but all the details are important for its success.

More recently a simple obturator has been described. This consists of a finger cot fixed over the end of a small catheter and wound loosely with a thin layer of gauze. This is inserted into the colostomy so that its tip is well inside the abdominal wall. The finger cot is then distended by air pumped into it through the catheter, the latter clamped and a water and air tight obturator is the result. When it is desired to remove the plug, the air is allowed to escape. The gauze wrapping prevents the rubber slipping out of the opening.

Careful regulation of the diet and regularity in emptying the bowel by enemas, with the use of one of these methods of dressing the colostomy, will overcome many of its annoyances. This is most important because these patients are apt to live a long time and proper management of the artificial anus gives them great comfort.

[1] J. Am. M. Ass., 1912, lx, 1419.

# STRICTURES OF THE GALL-BLADDER[1]

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ALTHOUGH the surgery of the gall-bladder is well developed, yet strictures of the gall-bladder have not received the study and consideration which they deserve.

Longitudinal septa have been described as being of congenital origin but transverse strictures and septa have been usually regarded as being acquired. Morton[2] reports a case in which there was a septum at the junction of the middle and lower thirds of the gall-bladder obstructing the lumen so completely that the opening could not be found with a probe. There were fifty stones lying in the sac distal to the obstruction and sixty-five in the proximal sac. Morton regarded the septum as being of congenital origin, but other authors have doubted this because the presence of the stones is believed to bear evidence of infection present. Moynihan[3] speaks of deformities of the gall-bladder without going into details as to their character or origin. Many references are to be found to the so-called hour-glass contraction.

This study was undertaken in order to determine first the frequency of strictures of the gall-bladder; second, their characteristics; third, the different etiological factors entering into their development; and fourth, their clinical significance.

This report is based upon the study of 1100 gall-bladders made while the author was serving as a volunteer assistant in the Pathological Institute of the University of Vienna. The gall-bladders are all from post-mortem examinations.

After the liver had been removed the gall-bladder was carefully inspected. Then with careful pressure of the hand upon the proximal end the bile was forced into the distal end, distending it in order that deformities might be better seen. The proximal end was then distended in the same manner by pressure upon the distal end. The gall-bladder was now removed from the liver and each end again distended by pressure upon the opposite end as before. This method of examining the gall-bladder is important, as otherwise many strictures would be overlooked.

Some of the gall-bladders were now opened and inspected and then fixed and sectioned for microscopic study. In others the bile was expelled by pressure and a mixture of melted wax and paraffin injected through the cystic duct. Following the injection the gall-bladder was suspended in the icebox or in running water to harden, after which it was split and removed, leaving a perfect cast of the lumen.

Of the eleven hundred gall-bladders studied one hundred were in babies varying in age from the seventh month of intra-uterine life to one month after birth; the majority, however, were in those dying within the first forty-eight hours after birth. Sixteen were between one month and twenty-one years of age and nine hundred and eighty-four were twenty-one years of age or over.

In sixty-two consecutive post-mortems upon babies, seven strictures were found; that is, in 11.29 per cent. Four of the strictures were in the middle portion of the gall-bladder and three were at the upper end. In this connection it must be remembered that congenital deformities are more frequent in the babies dying early than in those that survive, so that this does not mean that strictures are present in 11.29 per cent of babies who live. In one hundred and thirty-four consecutive examinations upon those twenty-one years of age or over, strictures were found in 17 cases, or in 12.7 per cent.

Strictures of the gall-bladder may be either congenital or acquired. In the past, as previously stated, they have been regarded as being of acquired origin only by most observers, but that many of them are congenital is proved by the fact that they are found in the very young babies. Cast No. 1

[2] Morton, C. A. Brit. M. J., 1908, Dec. 5.
[3] Moynihan. Gall-Stones and their Surgical Treatment.

[1] Read before the Portland Pathological Society, March 6, 1914.

was made from the gall-bladder of a baby dying within twenty-four hours of birth (Fig. 1). Cast No. 2 is from a child two years old (Fig. 2). In this case the distal end of the gall-bladder was buried in the liver so that the deformity was not seen until the gall-bladder had been dissected out. The specimen (Fig. 3) which I exhibit is from a child twenty months of age at death.

Uncomplicated congenital strictures in adults can be distinguished by the fact that there is an absence of the evidences of inflammation and by the fact that the characteristics of the congenital strictures differ from those of the acquired type. It is, however, often difficult to differentiate, from acquired strictures, congenital strictures in which changes have taken place due to an infection and gall-stone formation. Congenital strictures predispose to infection and gall-stone formation and these in turn to ulceration and scar formation.

Congenital strictures are of three types:

1. Annular strictures.

2. Those due to the projection of folds of the inner layers into the lumen. These usually occur in conjunction with the first or third type but sometimes occur independently. These, properly speaking, are septa, but I have classified them here owing to their obstructing the lumen.

3. The fundus stricture or elbow deformity in which the fundus is folded upon the body of the gall-bladder.

The annular strictures extend entirely around the gall-bladder but they do not produce the marked interference with the lumen seen in the elbow deformity. When the gall-bladder is not distended a stricture of the annular type may not be perceptible, but upon distention either by compressing one end as previously described or by the injection of fluid into the gall-bladder it is brought out. Sometimes there is a fold of the inner layers of the gall-bladder projecting into the lumen. This fold may involve the whole circumference of the gall-bladder along the line of stricture or only a portion of it.

Strictures, or more properly speaking, diminution in the size of the lumen due to folds of the inner layers, may occur in conjunction with the annular strictures as just described, or in conjunction with the elbow deformity to be described shortly, or independent of either (Fig. 4). Such a fold may take its origin from a narrow base extending entirely around the gall-bladder on a line perpendicular to the axis of the gall-bladder or from only a portion of such a line. The folds do not take their origin from a short base, but instead the mucous membrane is continuous for the whole length of the flap. In other words, the folds are rarely or never pedunculated, but instead the base of the fold is usually longer than the margin. There are some cases, however, in which the flap is attached for the entire circumference of the gall-bladder, the opening being rarely in the center, but more or less eccentric.

These folds may be so small as to be easily overlooked, or so extensive as to produce a complete obstruction—as seen in one of my cases in which there was a small sac at the upper end completely separated from the gall-bladder and containing a mucous fluid not stained with bile. In addition to the septum producing the complete obstruction, there was a narrow transverse, shelf-like projection near the middle of the gall-bladder. A case with a complete obstruction as in this

Fig. 1. Fig. 2.

Fig. 3.

Fig. 1. Congenital elbow deformity in child 1 day old. (Cast.)

Fig. 2. Congenital elbow deformity in child two years old. The distal end of the gall-bladder was buried in the liver. (Cast.)

Fig. 3. Congenital elbow deformity in child 20 months old. (Gall-bladder fixed in Kaiserling's solution distended with air.)

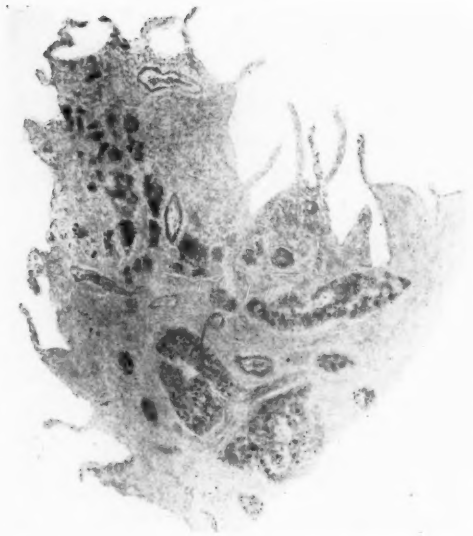

Fig. 4. Cross section of a transverse shelf-like projection extending into the gall-bladder. Muscle fibers in the center. Epithelium detached as a result of post-mortem change.

case has been described by Dévé. These folds are made up of the mucous and muscular coats when small (Fig. 4), but when extensive may contain a central fibrous layer.

The elbow deformity or third type is the most common congenital stricture (Figs. 5, 7, 8, and 9). In this condition there is a bending of the fundus upon the gall-bladder together with a diminution in the size of the lumen by a fold similar to that described in the second type of stricture. The outer coats of the gall-bladder appear too short for the inner coats and in place of dipping down into the fissure pass directly over, so that in some cases without careful inspection one might overlook the deformity (Fig. 5). The serosa passes over the under surface of the gall-bladder like a sac. In the subserosa may be found bands of connective tissue extending from the proximal portion of the gall-bladder to the distal, acting as guy ropes to maintain the deformity. The fibrous layer may pass over but usually dips down into the fold, in which case there are connective-tissue bands passing across the fissure from one side to the other (Fig. 6). In one such case as this I carefully cut the serosa, subserosa, and these connecting bands, permitting the distal portion to straighten out; but a narrowing of the lumen was still present.

The fold extending into the lumen is usually made up of the three inner coats folded upon themselves in such a manner that there are two layers of each with the mucosa on the outside and the fibrosa on the inside with the muscularis between. Usually the fibrous layers are fused together as one and in case of absence of the fibrous layer the two layers of muscularis are fused. The mucous membrane of each side is continuous with that of the gall-bladder of the respective sides throughout the entire length of the fold. This fold or septum always obstructs the lumen to quite an extent and in some cases it produces almost a complete obstruction.

The way in which this deformity occurs is not difficult to understand when it is remembered that the three inner coats—mucosa, muscularis, and fibrosa—differ in origin from the two outer—the serosa and the subserosa. At first the gall-bladder has only the three inner coats. It develops in comparatively a straight line. Later the peritoneum fuses to the under surface giving this surface its two outer coats. In the cases of the elbow deformity the fundus, either because of a too early fusing to it of the peritoneum or due to its meeting an obstruction, becomes folded downward upon the gall-bladder. In these cases when the peritoneum fuses to the under surface it does not extend into the crevice, but instead passes directly over, making the deformity become permanent.

Acquired strictures vary from those producing practically no perceptible obstruction to the lumen to those which produce almost complete obstruction. They may arise from:

1. Destructive lesions beginning with the mucosa.
2. Intramural infections.
3. Pathological processes beginning with the serosa.
4. Adhesions.
5. Chronic indurative processes.
6. Perforating wounds.
7. Malignant tumors.

Fig. 5.
Fig. 6.

Fig. 5. Double congenital elbow deformity of the gall-bladder. The peritoneum extended over the deformity so that it was scarcely visible.

Fig. 6. Schematic drawing of elbow deformity. Inner three layers involved in deformity, outer two passing over.

Fig. 7.
Fig. 8.

Fig 7. Congenital elbow deformity of gall-bladder. (Cast.)

Fig. 8. This gall-bladder shows an elbow deformity and has a well-developed mesentery. Drawing made from a specimen in the museum of the Pathological Institute of the University of Prague through the kindness of Prof. Dr. Gohn and Privat Docent Dr. Roman.

The destructive lesions beginning in the mucosa belong usually to one of the two types, the one in which the necrosis of tissue is due to the action of bacteria or their toxins. This forms a very frequent cause of ulcer and in some cases they are very extensive. In one of my cases there was a marked stricture about four centimeters from the fundus. On opening the gall-bladder a fold was found at this place diminishing the lumen to about one-fourth that below the stricture. A large scar was present upon the upper surface of the septum and another below involving a large portion of the surface of the gall-bladder. In all, over one-half of the inner surface was occupied by the scars. No stones were present.

In the other type of this first variety of acquired strictures the preceding ulcer begins as the result of pressure necrosis from stones. The pressure necrosis together with the resulting infection may not produce as extensive an ulcer as the first type but it often produces a deeper ulcer and one that more often leads to perforation.

Ulcers of the gall-bladder, when superficial, may heal without deformity, but in the majority of cases there is some deformity which may vary from a slight constriction to the typical hour-glass contraction (Fig. 10) in which the lumen may be almost completely obstructed.

The second form of acquired stricture results from intramural infections originating either from infected Luschka ducts or from bacteria or infected emboli brought through the cystic artery. I shall deal more extensively with the infections of Luschka's ducts in a future paper.

Strictures due to lesions beginning on the serosa are by no means rare. The pathological process may be a part of a general peritonitis or a local peritonitis arising from any one of the numerous causes.

Fig. 9.

Fig. 9. The proximal stricture is acquired, the distal one congenital. The gall-bladder was filled with black stones the size of an onion seed. (Cast.)

Fig. 10.

Fig. 10. Hour-glass contraction following an ulcer. Large fold of mucous membrane extending into the gall-bladder. (Cast.)

Those cases of stricture in which adhesions exist between the gall-bladder and other organs or the abdominal wall are grouped under the fourth class. Sometimes connective-tissue bands are seen extending crosswise producing constriction of the gall-bladder. Sometimes, as in one of my cases, there was a newly formed membrane similar to the so-called Jackson's membrane covering the gall-bladder.

Chronic indurative processes are responsible for strictures as well as for shrunken or so-called atrophic gall-bladders.

Under perforating wounds are included strictures resulting from operation, gunshot wounds, stab wounds, etc.

Malignant strictures are usually carcinomatous but I saw one case in which there was a developing metastatic melanosarcoma in the gall-bladder wall.

### CLINICAL SIGNIFICANCE

That strictures of the gall-bladder have a clinical importance can be easily seen by the study of post-mortem material. Acquired strictures interfere with the proper drainage and hence serve to harbor infections as well as aid in stone formation. Congenital strictures, so long as infection does not occur, are of but little clinical significance, but when infection does take place they have the same importance as the acquired.

Strictures, particularly those of the acquired type, may serve as etiological factors in the development of carcinoma.

In operating, the gall-bladder should be studied carefully for strictures, for if not recognized it may be that when the opening in the gall-bladder heals, the contraction of the scar tissue will make the lumen through the stricture smaller than before, so that in place of helping the patient he will be made worse. Further, in the elbow deformities, if the condition be not recognized, not only may the stricture be made smaller as just mentioned but the gall-bladder may not be properly closed and the bile may leak into the peritoneal cavity.

In conclusion I wish to thank Hofrat Professor Dr. Weichselbaum for placing the material at my disposal and Professor Dr. Oskar Stoerk for the opportunity of working in his laboratory and for the many suggestions he made.

# INVERSION OF THE UTERUS

By MICHAEL J. BUCK, M. D., Pittsburgh

IT does not often fall to the lot of one to meet two cases of inversion of the uterus. The comparative rarity of the accident naturally elicits an interest from the profession. What makes these two cases of especial interest is to know that they both bore children after the repair of the accident.

I think it well to give a description of my work, and then to refer to work of a similar character, especially that of Kehrer, who probably antecedes all others in this particular operation, a full description of which is described by Peterson.[1]

Case 1. Age 22 at the time of birth of second child at full term. On removal of the placenta the fundus of the uterus came down with the afterbirth and was clamped in the doubled-over cervix so tightly that the attendant physician was unable to reduce it. Calling to his aid a consultant, together they made an effort under complete anæsthesia to restore the uterus to its normal position, but were not successful. October 18, 1902, six months after the accident, the patient was sent to me for the purpose of having a hysterectomy performed for relief from the continual bleeding, as they expressed it. I found the patient in a very anæmic state, so much so that I had grave misgivings as to the outcome of the case, yet I could see no chance of bettering her condition by delaying the operation.

On the morning of the operation I ordered a saline per rectum 6 ounces, and hypodermoclysis of one pint under each breast. Ether was the anæsthetic used, to which she responded very kindly. After thorough cleansing of the parts the gloved finger was inserted and immediately met an obstructing mass about the size of a large orange, of the consistency of a myoma, bleeding from the entire surface, and by putting on traction with the double tenaculum forceps, holding the fundus, I passed my finger up surveying the body. The finger came in contact with the cuffed, or doubled over, os which grasped the inverted body of the uterus in its clutches, causing a decided stenosis of the body.

*Operation.* Grasping the cervix with two tenacula I made an incision between them beginning at the cervix and extending through the vault of the vagina into the pelvic cavity; then the incision was prolonged down through the neck and body of the uterus to the fundus, along the anterior wall of the organ. Notice that up to this time the fundus of the uterus was in the grasp of a double tenaculum and pulled back towards the rectum in a state of extreme retroflexion, while the cervix was grasped by two tenaculum forceps, one at either margin of the incision, and held by an assistant who also had control of the retractor in front. On completion of the incision the order of things was reversed, the uterus was placed in a position of complete anteflexion and the two tenacula that grasped the margins of the cervix incisions were brought down and back of the body of the uterus and crossed, so that the one on the right pulled over to the left and vice versa. By this means the cervix incision was held together, which minimized the loss of blood from the uterine arteries until the sutures could be placed. Now the uterus was, so to speak, folded upon itself back into place, and two rows of catgut sutures were inserted and the walls brought together, commencing at the junction of the body and the cervix. No difficulty was encountered in bringing the two margins into apposition and in completing a close union. When the body and fundus were repaired the uterus was replaced within the peritoneal cavity through the longitudinal opening in the vault and front wall of the vagina. Having accomplished this the remaining sutures necessary to bring the os together and to close the vault of the vagina were inserted. The patient came off the table but little the worse for the shock and slight loss of blood. The recovery was rapid and complete.

[1] Surg., Gynec. & Obst., 1907. iii. 196.

The history of Case 2 differs, in the main, but little from that of the first except that she was operated upon nine months after the injury, and recovery was as good as the first. The patient referred to in Case 1 gave birth to four children, and patient Case 2 to two children, subsequent to the operations.

I want to recall one thing to your notice in which my operation differed from the Kehrer, and that was in the transverse incision in the vault of the vagina which he made use of, while in these two cases I simply made the longitudinal incision. I extended the incision upwards in order to give me sufficient space to return the uterine body into the peritoneal cavity when it was repaired. One might think it difficult to complete the cervix repairs, but when the uterus was repaired and returned to its position I found no difficulty in inserting the sutures in the cervix by the aid of the tenacula that brought the

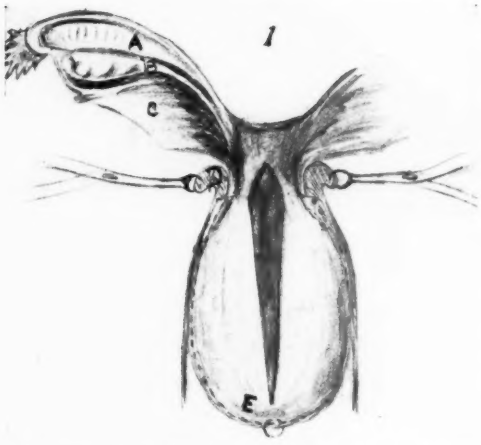


Fig. 1. Shows the inverted uterus with incision from cervix to fundus stayed by three tenacula, one to either side of the cervix and one to the fundus. Shows the concavity above where broad ligament and appendages are pulled down. A, fallopian tube; B, ovary; C, broad ligament; D, cervix; E, fundus.

margins together and retained them until the sutures were tied. You will notice that in neither instance did I find it necessary to chip out the wedge-shaped piece in order to lessen the resistance of the walls. This may have been accounted for by the recentness of the accident, the oldest being but nine months. I can readily understand that where an accident has been several years old, the tissues become more firm, have less resiliency, and may require the removal of the wedge-shaped piece, as was done by Kehrer to approximate the two surfaces snugly.

Up to the date of the above operations (1902), I had known nothing of Kehrer's work in this particular line, hence I was not governed by any lines or methods indicated by others or I probably would have made the transverse incision in the vagina, and no doubt would have been tempted to do so if I had encountered any serious difficulty in returning the body of the uterus to its normal position within the peritoneal cavity. As it was, I did not find any occasion to cross the incision. I found very material aid in having the assistant grasp the margins with tenacula and hold them in apposition until the sutures were tied.

I think it a mistake to take too deep a bite into the tissues with the needle; likewise less resistance will be encountered if the stitches are not passed too near the lining of the uterus; say about two-thirds of the thickness of the wall is sufficient.

To make a very practical illustration of the method of operation, one which I think will make it clear to every one, would be to take a rubber glove and invert one of the fingers. The hand, or glove proper, represents the vagina, and the inverted finger the uterus. Now, on looking into the glove, which represents the vagina, one sees the inverted finger, representing the inverted uterus. On turning back the cuff, or glove proper, and making an incision along the anterior wall of the inverted finger and then turning it as if it were inside out, stitching it together again on the posterior surface and then replacing it by up-ending it, one may readily understand the various steps of the operation.

Some considerable conjecture as to the exact cause of inversion leads me to speak of a case I saw with a very competent obstetrician a few hours after the accident, and where reduction was accomplished under anæsthesia without incising the uterus. This lady had had a rapid and easy delivery before the doctor entered the house, and no traction was made on the placenta because it came away unaided, yet this woman had a much lacerated os, which may have been responsible for the descent of the fundus, and this probably facilitated the taxis in reduction also.

The original operators made an abdominal incision, and by taxis with one hand in the abdomen and the other in the vagina attempted reduction, unfortunately with very indifferent success. Brown made an incision through the uterus posteriorly and dilated the os through the incision with some better results. Küstner incised the uterus posteriorly, and Kehrer was probably the first one who attempted to make the incision anteriorly. With our present knowledge and experience one is at a loss to know why any one should have selected the less accessible and more difficult route posteriorly unless it may have been through fear of injuring the bladder. In Case 1 I entertained this feeling, hence I

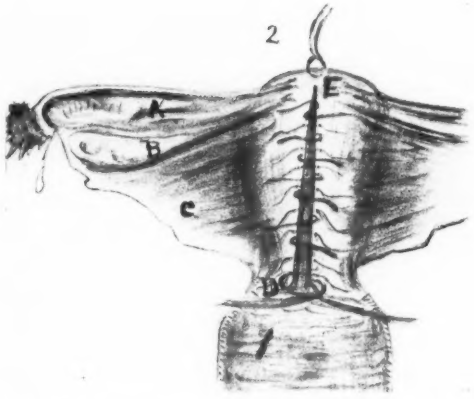


Fig. 2. Showing the uterus turned over and the tenacula or hooks pulling together the wound with the sutures inserted ready to tie. A, fallopian tube; B, ovary; C, broad ligament; D, cervix; E, fundus.

filled the bladder with eight ounces of saline in order that I might more readily detect its outline and thereby keep it out of harm's way, but I found this unnecessary in Case 2 because my knife was directed away from the bladder all the time. In fact, I cannot understand how one could injure the walls of the bladder as long as the cutting edge of the knife is directed back towards the uterus.

A matter that impressed me was that one is likely to err on the side of discretion by not making the incision long enough, that is, not down to the fundus, and, in attempting to turn over the uterus upon itself and unite it in its normal position, meet with great resistance which might tear the uterine tissue if the incision were too much skimped. It is much better to make a free incision and avoid the use of force or any violence, and by the use of a few artery forceps all hæmorrhage can be held in check until the bleeding points can be ligated or grasped by the sutures. I first attempted to turn the uterus over through an incision of the cervix extending down about two-thirds of the way through the uterus by

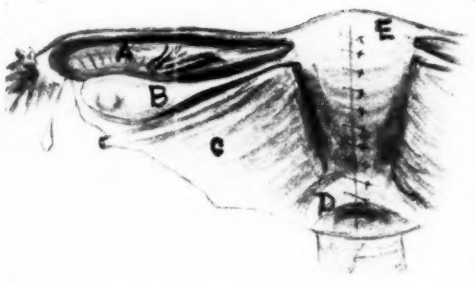


Fig. 3. The uterus repaired with sutures inserted and tied. A, fallopian tube; B, ovary; C, broad ligament; D, cervix; E, fundus.

the use of the index fingers inside the uterine wall and pressing the thumbs up against the fundus, and while I think I might have succeeded I believe it better practice to elongate the incision down to the fundus. After doing this I found it quite easy to adjust the organ, insert the sutures, and bring the two margins of the wound into apposition.

The appended sketches will serve to show roughly the successive steps of the operation. Fig. 1 shows the inverted uterus with the incision extending through the cervix and down to the fundus; Fig. 2 shows the uterus turned over and the sutures inserted; Fig. 3 shows the incision united by the sutures. Notice in Fig. 1 the relation which the uterus bears to the vagina—upside down, so to speak, and the os folded upon itself, which is due to the resistance offered by the broad and round ligaments to a complete inversion. In Fig. 2 the uterus being turned upon itself shows the corrected position with the incision gaping open and the sutures inserted and ready to tie. In Fig. 3 you will observe that all the sutures have been tied and the edges snugly approximated. Here you will notice the advantage of crossing the tenacula and pulling the right margin to the left and the left margin to the right until the knots of the sutures have been securely fastened.

# REPORT OF A CASE OF SPOROTRICHOSIS

By BENJAMIN F. DAVIS, Ph. D., M. D., Chicago
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From the Surgical Clinic of Dr. Arthur Dean Bevan, Rush Medical College

IN June, 1913, Mrs. M. F. presented herself at Dr. Bevan's clinic, where the following clinical notes and observations were made:

The patient is 77 years of age, white, born in Belgium, at present a resident of Chicago, but recently arrived from South Dakota. She comes complaining of several ulcers on the right forearm, of swelling of the right forearm and hand, and of morning vertigo and nausea. About six months ago the patient was out in the field pitching hay, and a "hay needle" or "cactus needle" pierced the skin of the palm of the right hand just proximal to the web between the middle and ring fingers. In the course of the next two or three weeks a lump formed at the point of injury and became tender and somewhat painful; this lesion has persisted up to the present time. Occasionally it discharges small quantities of blood and serum. A month after the primary injury the hand and forearm became swollen and painful, apparently without cause, and several red linear streaks were observed on the back of the hand and forearm. This trouble disappeared in two or three days, only to reappear at intervals for a month when a small lump, red, with a bluish edge, somewhat painful and tender, was noticed on the dorsal surface of the forearm near the external epicondyle of the humerus. This lump gradually increased in size, a "blister" formed, and "water" oozed out. Since then several more lumps similar to the first have developed on the forearm and hand between the point of injury and the lesion on the elbow. Some of these discharge a sero-sanguinous exudate from time to time; others have not yet broken down.

General examination disclosed nothing beyond the senile changes usual in fairly well preserved persons of 77. Locally there was found the lesions mentioned as occurring on the right hand and forearm. The primary lesion was a crusted papulo-pustule with bluish-red edges, the size of a split pea, painless and very slightly tender on pressure. The lesions on the forearm presented the same general characteristics; in size they varied from a diameter of a few millimeters to that of a quarter-dollar. Temperature was normal.

The blood examination resulted as follows:

| | |
|---|---|
| Hæmoglobin | 75 per cent (Dare) |
| Leucocytes | 9600 per c.mm. |
| Differential: | |
| Small mononuclears | 16 per cent |
| Large mononuclears | 6 per cent |
| Indentate nuclears | 2 per cent |
| Polymorphonuclear neutrophiles | 2 per cent |
| Polymorphonuclear eosinophiles | 3 per cent |

A diagnosis of sporotrichosis was made, based on the history and clinical findings, and excision of the largest and most active lesions advised. This was done on June 3, 1913, and the wounds closed without drainage. Healing was uneventful. The patient was placed on large doses of potassium iodide, and when last seen, about six weeks after operation, appeared to be making very satisfactory progress.

Pus from the excised lesions was inoculated into glucose and blood agar media. After seven days a typical sporothrix colony appeared in a glucose-agar slant at room temperature, and three days later several similar colonies were observed on a blood-agar slant at 37 degrees C. The organism was in pure culture in both instances.

Smears from the pus were examined with reference to the proportion of eosinophil leucocytes but none were found.

Parts of the lesions were embedded in celloidin, sectioned and stained with hæmatoxyline and eosin. Under the microscope these sections presented areas of round-cell infiltration of the ciorum and subcutaneous tissues with, in addition, a few epithelioid cells, and occasional giant-cells (Langhans type). Marked, diffuse thickening of the walls of the arteries was noticed. There were no evidences of local eosinophilia. No organisms were recognized.

Agglutinative and opsonic tests were made by Mr. Clifford P. McCullough according to the technique described by him a short time ago.[1] Only the highest dilution at which agglutination occurred is given in the table.

Table 1. Agglutination of sporotrichal spores by patient's serum (normal=0)

| Date | Agglutination at dilution of: |
|---|---|
| July 4 | 1:32 |
| July 5 | 1:32 |
| July 6 | 1:32 |
| August 2 | 1:96 |

[1] J. Am. M. Ass., 1914, lx, 1156.

TABLE 2. Opsonification of spores of sporothrix by patient's serum (normal = 1:12).

| Date | Opsonic extinction at dilution of: |
|---|---|
| July 4 | 1:96 |
| July 5 | 1:96 |
| July 6 | 1:96 |
| August 2 | 1:384 |

A serum-free mixture of leucocytic suspension of spores and salt solution served as a means of control, the dilution of serum in which no more cells engaged in phagocytosis than in the serum-free mixture being called the point of opsonic extinction.

Comparative and opsonic agglutinative tests were made by Mr. McCullough, using, as reported in the article cited, five other strains of sporothrix, and the heated and unheated serums of normal persons, of a patient with sporotrichosis of the eye, and of rabbits immunized with a suspension of sporothrix spores, but in all of them it was impossible to differentiate the various strains of the organisms, although the immune sera were readily distinguishable from the normal by their high content of immune bodies.

In a very thorough discussion of sporotrichosis in man, Hamburger[1] groups the features which are helpful in the differential diagnosis of sporotrichosis as follows:

"Clinical: The occurrence in men between the ages of 15 and 45 in the country and farming districts (but also in the cities). The occurrence in farmers, fruit and vegetable dealers, berry-pickers, florists, etc. A history of preceding trauma by nails, wire, knife, hammer, bites of animals (rat, hen), pinprick, etc.

"The slow period of incubation following the initial trauma; the insidious onset and slowly progressing course; the slow ascending infection following the course of the deep lymphatics.

"The production of characteristic small, round, hard, subcutaneous nodules and their uniform evolution into softened cold abscesses or cutaneous ulcers.

"The long-drawn-out clinical course of the disease with little or no pain or temperature and little or no effect on the general health.

"Laboratory: The local and general eosinophilia. The presence of eosinophiles in the initial chancre, in the nodules, in the pus from broken-down nodules and in the blood of experimental animals as well as clinically. It will be of great interest, therefore, to see whether more extended observations will show the eosinophilia to be of diagnostic importance.

"The cultivation of the organism on artificial mediums, the growth of sporotrichium being characterized by its slow initial appearance, its ready growth on two per cent glucose agar at room or incubator temperature, its raised corrugated appearance on slant agar and its radiating flower-like appearance in stab-culture, its brownish-black pigment production in old cultures and on four per cent glucose agar, its branching septate mycelium and pear-shaped spores."

The clinical history and the physical examination usually disclose sufficient evidence upon which to base a positive diagnosis of sporotrichosis. From the laboratory side, the cultivation of the organisms on artificial media and the demonstration of immune bodies in the patient's serum appear to be of especial importance. Local and general eosinophilia, judging from its absence in the present case and in the case described by Wilder and McCullough (cited above), is probably an inconstant factor and, therefore, unreliable for diagnostic purposes.

The local use of iodine as the tincture or as Lugol's solution, and the administration of potassium iodide internally in large doses, is the treatment usually recommended. These measures, especially the iodide by mouth, should be continued until the last vestige of the disease disappears. In advanced or obstinate cases copper sulphate internally in one-eighth gr. to one-half gr. doses in capsules should be given a trial in conjunction with the iodides. Complete excision of certain of the lesions, in the absence of acute exacerbations with demonstrable lymphangitis, appears to be a commendable procedure. The value of vaccination with suspensions of killed spores, and of the X-ray as therapeutic measures, cannot at present be stated, but would seem to be sufficient to justify trial.

The writer wishes to thank Dr. Arthur Dean Bevan for permission to describe this case and to express his gratitude to Mr. McCullough for the immunological work done.

[1] J. Am. M. Ass., 1912, lix, 1590.

# SPINAL ANÆSTHESIA IN GYNECOLOGY[1]

By GEORGE GELLHORN, M. D., F. A. C. S., St. Louis

BEFORE an audience which is thoroughly familiar with the history and technique of spinal anæsthesia, only the two following questions require discussion: First, is there a field for an anæsthesia other than the popular ether drop method? Secondly, do the results obtained with spinal anæsthesia justify its wider application in gynecology?

It may at first seem somewhat dogmatic to assert that the severity of an operation stands in direct proportion to the amount of ether inhaled; but one has only to watch the work of surgeons who are giving particular attention to the subject of anæsthesia to see a conscious effort throughout to reduce to a harmless minimum the quantity of ether administered. If we turn to the professional anæsthetist [Coburn (1)], we hear him propose the slogan, "Conserve the patient's resistance," and warn against ether as an anæsthetic which impairs physiological agencies. "To handicap nature needlessly with the anæsthetic is sometimes to turn the tide of battle against the one we are striving to aid." And if still further proof were needed for the premise that the popular ether anæsthesia is not an ideal procedure and therefore not applicable in all cases, we have but to recall the multitude of modifications, the many inventions of new methods, and the numerous combinations of old and new modes of anæsthesia which have been proposed within the last ten or fifteen years.

Statistics would quickly settle the question, but unfortunately there are no reliable statistics to be had. Note the wide divergence of the figures collected by Gwathmey (2). While in Europe one death occurred in 16,302 ether anæsthesias, in America the proportion was one to 5,623; and neither percentage is conclusive. I know personally of several ether fatalities that have never found their way into print and into statistics, and I am sure that most of you have made similar observations. Nor does the immediate mortality rate, even if it were correct, tell the whole story. If the patient survives the operation itself, but dies a few days or weeks later, it is at present impossible to state to what extent the anæsthesia account should be charged with the fatal outcome; but it is not unreasonable to suppose that the anæsthetic had something to do with it. The statistics of Petren (3) are at least suggestive in this respect. He studied the causes of death after all operations performed within the last five years in all the hospitals of Lund, in Sweden. There were in all 8,440 operations, with 304 deaths. Of these, 44 were due to pneumonia and 15 to pulmonary embolism — one-fifth of all post-operative deaths due to causes which are generally attributed to the effects of inhalation narcosis![2]

We believe and we teach that there is no better protection against peritoneal infection than the peritoneum itself, yet a certain percentage of our cases still die from sepsis; and the man who could show accurately just how far the anæsthetic weakens this protective barrier would render us an immeasurable service.

The relation between anæsthetic and post-operative morbidity, which, though it may eventually terminate in recovery, yet entails physical suffering and often also economic hardship, is even more elusive to the statistician, but none the less real. Certainly the men who modified the ordinary ether narcosis or invented new methods must have been actuated by unfavorable experiences which rendered changes desirable, and not by a desire "to drive in nails upon which to hang their names."

All of these innovations, however, have found only a very limited following, and from one end of the continent to the other the open ether method still reigns supreme. This is the more remarkable as every operator consciously or unconsciously is in everlasting

[2] I am, however, aware that pulmonary complications may sometimes follow abdominal operations even when ether has not been used.

[1] Read before the American Gynecological Society, Boston, May 19, 1914.

dread of ether. He feels that every drop of it means an additional risk to his patient, and it is partly for this reason that he performs his task with an excessive speed which is not always consistent with the best interests of his client. In the case of a physician requiring surgical treatment, it is a common observation to see him shrink, not from the operation, but from the ether narcosis; yet so strong is habit that the majority, despite their fears, prefer to inhale ether and, metaphorically speaking, bury their heads in the sand so as not to hear or see anything.

Lest there be a misunderstanding, let me state emphatically that this is not an argument for abolishing ether inhalation altogether, but a protest against its indiscriminate employment. Neither can it be my purpose to recommend spinal anæsthesia as an allsufficing method of surgical anæsthesia; for it obviously would be just as bigoted to become wedded to this or, indeed, any other single method and to forget that not our personal predilection but the needs of the individual case alone must govern our choice of an anæsthetic.

The German and French literature, once so full on the subject, now contains but a very few reviews of large series of cases operated upon under spinal anæsthesia. This can mean but one thing; namely, that the value of this procedure has been established beyond a doubt, and that the question has been practically settled. In Italy and Russia the interest in the method is increasing, to judge from a fairly large number of contributions listed in the Index Medicus. From England and British India series of a thousand and more cases are recorded by individual operators. Only in America is the number of reports small, and they remain limited almost altogether to the same few men who have practiced and written on spinal anæsthesia for years. Yet, from personal observations and private communications, I am inclined to think that this method is really more widespread in this country than would seem at first sight; and I therefore consider it most appropriate at this time that an authoritative body like the American Gynecological Society should discuss the question, so that any merely conventional objections may be properly dealt with. But there is another reason why our society is the right forum for this discussion, for it should be remembered that it is in the field of gynecological operations that spinal anæsthesia is of the very greatest advantage and shows its most impressive results.

It is but natural to anticipate at once a query as to the mortality from spinal anæsthesia. Unfortunately, here again statistics fail us, as is demonstrated by the wide divergence of the figures reported. While Hohmeier and Krönig computed one death in 200, and Strauss one death in 3,500 spinal anæsthesias, Thomaschewsky recorded one death in 17,847 cases (4).

The majority of fatalities occurred a number of years ago when spinal anæsthesia was still in its infancy. It is a sad but inevitable fact that in our empirical science, and particularly in surgery, every progressive step exacts its toll of human lives. In spinal anæsthesia the anæsthetic itself has, I believe, nothing to do with the mortality. The three agents which alone need be considered for clinical purposes — stovaine, tropococaine, and novocaine — are more or less equivalent. While my personal experience is limited to novocaine, spinal anæsthesia will be treated in this article without reference to a particular drug.

The safety of spinal anæsthesia depends first and foremost on its accurate technique, as it has been evolved in the last twelve years. Although the injection into the arachnoidal sac is a very simple procedure, the strictest observance of even the most minute detail is of paramount importance. To all who wish to employ spinal anæsthesia I earnestly recommend the description of the technique by Sellheim (5), which takes into account every particular step of the method. Thanks to improvements in technique, the serious complications of former days have almost altogether disappeared. Death from spinal anæsthesia is due to paralysis of the respiratory center in the medulla, caused by the rapid ascent of the anæsthetic; and this disaster can practically be avoided, as attested by the thousands of cases operated

upon by Krönig (6), Sellheim (5), Morrison (7), Dax (4), Schuette (8), Helm (9), Allen (10), and many others. One must agree with Krönig when he demands that any reports of death due to spinal anæsthesia must hereafter contain all details of the technique employed before they can be admitted to serious consideration. A case in point has recently been published by A. E. Rockey (11); but it cannot claim any weight in this question, as the report contains neither the amount and concentration of the anæsthetic used nor the exact mode of injection.

The number of deaths from spinal anæsthesia which have occurred in spite of all precautions is undoubtedly very small, and must be classed with those unavoidable accidents which are due to our human limitations.

If the anæsthetic reaches the medulla in less than the toxic dose, collapse will be the result, a complication which has steadily decreased in frequency with growing experience. I have observed it but once in one of my earliest cases, that of a stout and asthmatic woman, with nephritis and a flabby heart, in whom a vaginal hysterectomy was to be performed. In this case a typical collapse occurred when the patient was brought too abruptly from the sitting into the dorsal position, even before the operation had commenced. An injection of strychnine and the introduction of oxygen quickly revived her, and the operation was successfully and painlessly carried out.

Minor complications, such as air hunger and tendency to faint, are probably due to the decided effect of spinal anæsthesia upon lowering the blood-pressure. They are readily combated by stimulation, but usually subside without any treatment.

But if there is no longer any physical danger, is not the psychic trauma a serious drawback? This objection is caused by a gross misconception of the actual conditions. The patient is not conscious in the sense in which the operator or the audience are conscious. It should be borne in mind that the patient's sensibilities are dulled when she enters the operating room. She has received bromides the day before the operation and a dose of veronal at bedtime, and she is under the influence of an injection of morphine-atropin or morphine-scopolamine when spinal anæsthesia is about to be administered. In many of the German clinics she is brought to the table in "twilight sleep." The intraspinal injection itself is no more painful than the hypodermic injection given half an hour previously; and since the operative manipulations are not perceived, the preliminary administration of morphine can exert its soporific influence to its fullest extent. It is interesting to compare the apprehensive attitude of bystanders with the composed frame of mind on the part of the patient. The operator himself may at first be affected until the novelty of the experience has worn off. His nervousness is quite pardonable, for we all are more or less creatures of habit and we have become used to seeing our patients in a state of unconsciousness. Personally, I prefer to chat with my patient during the operation rather than hear her labored breathing, her deep snoring, or the rattling of mucus in her throat, all of which remind me unpleasantly of the interference with unobstructed oxygenation of her blood.

Let us consider further advantages of spinal anæsthesia during the operation: Some patients are nauseated and even vomit, but almost without exception the emesis is very slight and rarely occurs more than once. The nature of the operation is not the cause, for the vomiting may occur even before an incision is made. Allen and Donaldson (12) found that they could diminish nausea and emesis still further by giving a light breakfast before the operation.

The abdominal walls are more fully relaxed than with any other method of surgical anæsthesia, and the intestines remain, in most cases, quietly within the peritoneal cavity. This facilitates the application of retractors, and diminishes traumatism to the abdominal parietes; it obviates brusque handling of the viscera with its well-known sequelæ, frequently eliminates the use of gauze packs, and generally renders operative manipulations easier. All this tends to lessen the operative shock; and as nerve

impulses do not reach the brain, spinal anæsthesia is the ideal measure of anoci-association. "With most other anæsthesia, the shock of a prolonged operation is reënforced by the progressive toxæmia of the anæsthetic. With spinal anæsthesia the emergence of the nerve-roots from the anæsthesia as the operation proceeds usually results in the patient leaving the operating table in a better condition than he was during the early stages of the operation." [Babcock (13).]

It is quite true that analgesia is not perfect in all cases. Indeed, to claim invariably good results would be to invite a justifiable skepticism; and on the other hand an occasional failure in obtaining complete freedom from pain should not be sufficient to condemn the method. There are two possibilities: either an attempt at spinal injection fails altogether, or else, the spinal injection having been made, analgesia is more or less incomplete. Thus far I have been unable to perform spinal anæsthesia in six cases. Twice the tumors were monstrously large, so that the patient could not bend forward and thereby separate the vertebræ sufficiently for the introduction of the needle. In three cases, two of them complicated by obesity, the needle entered the spinal canal, but no fluid escaped, indicating perhaps abnormal conditions within the arachnoidal sac which rendered the injection of the anæsthetic inadvisable. In one instance the spinal fluid was mixed with blood, and the injection, therefore, omitted. In such a case a part of the anæsthetic would leak into the circulation, and the remainder would *a priori* be insufficient to produce analgesia.

In about 150 cases where spinal injection was performed, analgesia was insufficient on three occasions, so that a general anæsthetic was required throughout the operation. This was due to faults in technique which I hope to avoid in future. Repeatedly a few whiffs of ether had to be given, either in the beginning, because of great nervous excitement of the patient, or else at the end of long and severe operations. Not infrequently the inhalation of alcohol or some aromatic oil (oil of lavender or orange) had a satisfactory though only suggestive effect.

Whatever the causes be, one simply has to count on a certain small percentage of failures. For this fact we have enough statistical material, from which I have selected a few of the more recent reports. Krönig: in 2,140 gynecologic operations, chloroform or ether was added in 1,127 cases, counting even the smallest amount given. Sellheim: in 1,000 operations, complete and undisturbed anæsthesia was observed in 86.1 per cent and a total of disturbances in 13.9 per cent. Morrison: in 1,295 cases a general anæsthetic was required on 36 occasions — throughout in 17 operations and during the latter stage in 19. Allen: 320 cases with 19 partial or complete failures to produce anæsthesia. Helm: 1,419 cases with 105 failures, making 7.4 per cent. Dax: in 1,500 cases there were 6 complete failures, 37 incomplete analgesias without addition of a general anæsthetic, and 38 incomplete analgesias with the addition of a general anæsthetic.

After all, the addition of a minimum amount of ether, which is too small to injure the organism, is not a serious disadvantage. In one of my cases a difficult abdominal panhysterectomy for large bilateral pustubes with extensive adhesions, the operation lasting almost one and one-half hours, 190 drops of ether were used, and I consider this preferable to repeating the spinal injection as recommended by Richardson (14) and others.

The range of spinal anæsthesia in our special field of work is unlimited. The accompanying tables of my operations will show at a glance that every kind of gynecologic operation can be done with its aid. As, in some instances, multiple operations were performed on the same case, the number of patients subjected to spinal anæsthesia is slightly smaller. Minor operations, such as curettages, trachelorrhaphies, amputations of the cervix, or hæmorrhoidectomies, which were done in conjunction with major procedures, have been left out of consideration.

Of these cases four have died. These fatalities, which occurred about two years ago, have already been reported in my paper (15) at the meeting of the American Medical Association in Minneapolis, June, 1913, but

TABLE I

*Abdominal Operations*

| | |
|---|---|
| Panhysterectomy for fibroids | 13 |
| Panhysterectomy for cancer of cervix (Wertheim) | 2 |
| Panhysterectomy for cancer of ovary | 1 |
| Panhysterectomy for pus-tubes, ovarian abscess, etc. | 11 |
| Hysterectomy for cancer of body | 1 |
| Hysterectomy for post-operative adhesions, etc. | 3 |
| Enucleation of fibroids | 1 |
| Supravaginal amputation for fibroids | 5 |
| Supravaginal amputation for intraligamentary ovarian cyst | 1 |
| Ovariotomy | 1 |
| Salpingo-oöphorectomy | 15 |
| Ectopic pregnancy | 6 |
| Post-operative hernia | 5 |
| Herniotomy | 1 |
| Salpingostomy | 7 |
| Appendectomy | 29 |
| Operation for retroflexion (Montgomery, Baldy, etc.) | 16 |
| Operation for cystocele | 4 |
| Exploratory | 3 |
| Nephrotomy | 1 |
| Implantation of ureter into bladder | 1 |
| Total | 127 |

TABLE II

*Vaginal Operations*

| | |
|---|---|
| Hysterectomy for fibroid | 3 |
| Hysterectomy for cancer of body | 1 |
| Hysterectomy for rectovaginal tumor | 1 |
| Hysterectomy for metrorrhagias | 2 |
| Radical hysterectomy for cancer of cervix (Schauta) | 5 |
| Hysterectomy for prolapse | 3 |
| Interposition (Watkins-Schauta) | 3 |
| Vineberg operation for prolapse | 4 |
| Ovariotomy | 2 |
| Cæsarean section in patient with exophthalmic goiter | 1 |
| Enucleation of submucous fibroids | 2 |
| Operation for complete tear | 2 |
| Perineorrhaphy | 9 |
| Vesicovaginal fistula | 1 |
| Rectovaginal fistula | 1 |
| Dudley operation for incontinence of urine | 1 |
| Excision of vulva for cancer | 1 |
| Total | 42 |

may here be repeated for the sake of completeness. It is, perhaps, significant that spinal anæsthesia was insufficient in two of these four cases, and ether had to be given from the beginning. One of these was an extended vaginal operation for cancer of the cervix. This patient died of shock. The other patient died of peritonitis, possibly caused by an injury to the intestines. The remaining two patients died of sepsis; one had cancer of the cervix and died five days after a Wertheim operation; the other had a large myxomatous fibroid with most extensive adhesions, and died two weeks after operation.

The post-operative course, as a general rule, cannot fail to impress an open-minded observer. The surgeon is familiar with the post-operative behavior of his patients more in a theorectical way, if I may so express it. He sees them at short moments only, and it is the nurse who is constantly with the patient who is more competent to judge any differences in the patient's condition after spinal or ether anæsthesia. It is, therefore, an argument of weight if experienced nurses without exception declare that the post-operative care of "spinal cases" is infinitely easier; that vomiting is, in the majority of patients, lessened to a minimum or altogether absent; that nausea and thirst are diminished, the general *malaise* reduced, the sharp wound pain markedly decreased, the ability of taking nourishment and thereby aiding the resiliency of the organism little or not at all impaired; micturition and peristalsis are usually uninfluenced by spinal anæsthesia. But the best argument is advanced by those patients who have had both kinds of anæsthesia and declare in favor of the spinal injection. I can refer to several such cases. In one instance the patient had been operated upon elsewhere under ether a year ago, and again by me under spinal anæsthesia; and when a small perineal plastic operation became necessary, which I intended doing under ether, the patient vigorously objected and insisted on having spinal anæsthesia a second time. Do not such observations outweigh any theoretical objections?

There is, however, no denying that in a certain percentage of cases annoying after-effects are noted after spinal anæsthesia. The most objectionable post-operative symptom is headache, usually of the occipital type, which may be more or less intense and last for hours or days. In its graver form I have observed this complication but once. It existed from the third to the ninth day after operation, but finally yielded to hot packs. The milder forms are usually relieved by bromides. Such headaches are possibly due to a delayed absorption of the

anæsthetic. Krönig has observed headaches in 897 out of 2,074 cases, or 47 per cent. He remarks that the choice of the anæsthetic plays no part in the causation. The frequency and intensity of headaches seems to him to depend more on the social stratum and the age of the patient. Wage-earners, women from the rural districts, and those beyond the age of fifty suffered less; neuropathic individuals suffered severely from these headaches.

Morrison noticed headaches in 15 per cent of his cases, and found that persons prone to headaches on slight cause furnished the largest group. Schuette believes that patients suffering habitually with headaches should be excluded from spinal anæsthesia; he observed that coffee or brandy given immediately after operation seemed to exert a preventive effect.

Backache lasting one or two days was noted in ten of my cases. An ice bag applied to the site of injection usually relieved the symptom. No notes have been made of backache after a corresponding number of general anæsthesias.

In two instances the bedside notes recorded numbness in the legs, and one patient complained of pain in the feet on the day following the operation. Usually, however, free mobility of the legs is regained within an hour or two after operation.

A partial paralysis of one leg, which, however, gradually subsided, was observed in one case in which the needle was not introduced in the median line and probably pierced one of the sacral nerves.

One patient, who had stood an abdominal panhysterectomy for fibroids exceedingly well, developed a slight psychic disturbance during the next two days, but eventually recovered completely. Siemering (16) quite recently mentioned a case of mental disturbance (amentia) after a gynecologic operation which terminated in spontaneous recovery, and concluded therefrom that patients with an unstable psychic equilibrium had better be subjected to general narcosis.

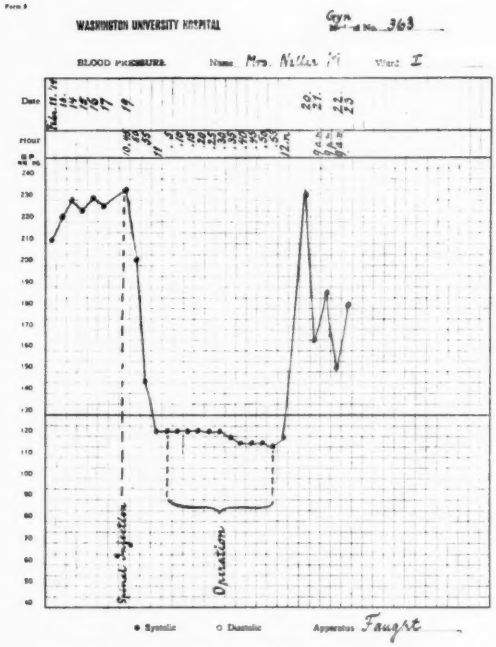
Alarming late complications which were now and then reported in the earlier days of spinal anæsthesia seem to have become less frequent, and all authors agree nowadays that lasting ill effects are conspicuously absent. Among Helm's 1,419 cases there were 174 with late complications, such as headaches extending over months, paræsthesias and neuralgias of the legs, etc., but all were cured finally. He suggests that these were perhaps due to slight infections and recommends increased attention to asepsis.

That such complications, however, cannot always be charged to spinal anæsthesia is proved by a case that came to my knowledge recently. A woman developed paralysis of both legs soon after myomectomy in spinal anæsthesia; but when she was seen about two years later she exhibited the typical picture of tabes, and Wassermann reaction proved positive.

At times post-operative symptoms may give rise to grave fears and yet subside spontaneously. Such a case was reported by Vogel and Kraemer (17). A man of 75 years, suffering with asthma, was subjected to herniotomy under spinal anæsthesia. After operation there ensued a complex of symptoms resembling heart block and consisting of bradycardia (36 beats a minute), dyspnœa, insomnia, debility, and tenesmus; but all these symptoms disappeared gradually.

It seems to me that we have to deal here with an unusually pronounced effect of spinal anæsthesia upon the blood-pressure. Babcock has paid particular attention to this phase of the problem and has observed that involvement of the upper dorsal nerve roots causes a slowing of the pulse down to 40 or 30, while the blood-pressure may sink to its lowest level. The involvement of only the lower spinal segments may produce merely a slight reduction of the pulse rate and blood-pressure. The action on the circulation begins soon after the motor paralysis reaches its acme, or in about fifteen or twenty minutes, and gradually passes off.

That the strict observance of an improved technique would, in all probability, avert an involvement of higher segments, has already been mentioned; but even when the injection has been done with all necessary precautions, the effect on blood-pressure may be quite marked, as exemplified in the following chart.




Morrison found a faint and transient albuminuria in a few patients whose urine was free from albumin before the operation.

A more regular phenomenon which thus far seems to have escaped the attention of observers is the appearance of acetonuria after spinal anæsthesia. My findings will later be reported in detail. For the present it may suffice to say that out of twenty cases acetone occurred in the urine in all but one case. The acetonuria disappeared spontaneously about five days after operation, and in no instance did it affect the general condition of the patient or interfere with the recovery.

The occurrence of all these more or less annoying after-effects enumerated above, and even the possibility of more serious complications, must be clearly understood if a true picture of spinal anæsthesia is to be developed. On the other hand, the undesirable sequelæ should not be unduly magnified so as to overshadow the truly remarkable possibilities of the new method. It has been shown in Tables I and II that *all* gynecologic operations can be performed under spinal anæsthesia. It remains to be said that in a large number of these cases the condition of the individual patient was such as to strongly contra-indicate the inhalation of ether unless the additional danger from the narcosis was to be superimposed upon the risk of the operation itself. My own 169 operations are so few that I would not venture to refer to them were it not that operators with an infinitely larger material have already shown us the brilliant achievements of spinal anæsthesia in operative series of impressive size. Like many others, I have employed spinal anæsthesia at first only in cases on which I was afraid to operate under ether — serious or debilitating diseases complicated by myocarditis, nephritis, exophthalmic goiter, advanced age, etc.; and only when spinal anæsthesia stood this particularly severe test did I extend the application of the method without, however, losing sight of the legitimacy of ether or nitrous oxide in suitable cases.

What, then, are the indications for or against the use of spinal anæsthesia?

Doederlein and Krönig regard as the chief advantage of spinal anæsthesia the fact that we have to deal in the main with a form of local anæsthesia in which the greater part of the poison is deposited around the site of the injection and is thus rendered harmless, while in every inhalation narcosis the poison enters the circulation and produces undesirable toxic effects on the other organs, particularly the heart and lungs. Therefore, post-operative cardiac disturbances and pneumonias occur far less frequently after spinal anæsthesia than after inhalation narcosis.

It is, moreover, a matter not of theory but of actual experience that patients with pulmonary troubles or heart lesions bear a spinal anæsthesia better than inhalation narcosis. The same is true of patients with kidney disease or diabetes, and it has further been proved that operations on aged people lose many of their dangers when performed in spinal anæsthesia.

Bainbridge (18) sums up the question by saying tersely, "The indications for spinal anæsthesia are the contra-indications for inhalation anæsthesia."

It has abundantly been proved that spinal anæsthesia is less dangerous than ether; and if its employment is not only justified but demanded in "bad" cases, it is but logical to use it in cases which are not complicated by other organic or systemic disturbances.

As a matter of fact, Doederlein and Krönig, Allen, Babcock, and most of the other operators with large personal experience draw just this conclusion. They prefer spinal anæsthesia over inhalation narcosis in all operations with a high mortality, such as operations for cancer and fibroid; but since there is a certain degree of risk in any laparotomy, they use spinal anæsthesia in all abdominal operations in preference to inhalation narcosis.

That the storm and stress period of spinal anæsthesia has passed and mere enthusiasm has given way to wise caution is shown by the list of contra-indications in which most authors concur. This includes pronounced kyphoscoliosis and other marked anomalies of the spinal column and pressure points along the spinous processes which might indicate abnormal conditions within the arachnoidal sac, such as adhesions or lack of cerebrospinal fluid; furthermore, diseases of the central nervous system, profound shock, or marked hypotension from other causes, sepsis, and fevers of unknown origin. Spinal anæsthesia is also contra-indicated in neuropathic individuals and where there is a strong prejudice against the method. Whether it is applicable in children is still a mooted question in which I have no personal experience. I can affirm from numerous observations that syphilis is not the contra-indication it was formerly believed to be.

Suppurations and eruptions near the desired site of injection forbid the use of spinal anæsthesia until aseptic conditions can be established.

I have endeavored to present to you the present status of spinal anæsthesia in as objective a fashion as my own leaning toward the new method would permit, and to draw a picture in which light and shadow are evenly divided. Since Röntgen's discovery, no greater, no more stupendous advance in our therapeutic procedures has been made than this method of rendering the most extensive operations absolutely painless. For this we gynecologists above all others must feel particularly grateful to Corning, Bier, Tuffier, and all those who with indefatigable zeal have improved the technique of spinal anæsthesia until to-day it appears to be perfect in all its essentials. Spinal anæsthesia has had to face skepticism and prejudice. The former must yield before the positive proofs which the advocates of spinal anæsthesia can produce, and prejudice will eventually wear itself out. If Donaldson complains that despite the gratifying results of his first year's work prejudice on the part of the public, both medical and lay, has interfered with his efforts, he may remember that less than eighty years ago the followers of Ephraim McDowell were publicly denounced as murderers and subjected to persecution.

But ovariotomy has survived prejudice, and so will spinal anæsthesia. A method by which many human lives may be saved cannot disappear from our therapeutic treasury, and it requires no prophetic gift to predict that from year to year it will become more appreciated and maintain its high place among the methods of surgical anæsthesia.

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# A STUDY OF THE END-RESULTS OF INTERPOSITION OF THE UTERUS [1]

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OF the many operations which have been suggested and performed for the cure of prolapse of the uterus, descent of the vaginal walls, and the accompanying vesical hernia, none, unless it is that described by Baldwin in his thesis for entrance to this society in 1912, has given us such satisfactory results as those obtained from interposition or transposition of the uterus, when the indications for this procedure have been properly selected.

The Watkins operation, as described by Thomas J. Watkins of Chicago, differs in many ways from the technique employed by Schauta, Wertheim, and others, presenting a refinement of gynecological technique indigenous to American surgery. The foreigner has as yet but a vague conception of plastic surgery, especially of pelvic plastics; neither does he take into consideration the weight or size of the uterus that he is about to interpose, nor the type of prolapse he is dealing with; this perhaps explains the failures so often reported.

The normal supports of the uterus may be enumerated as follows:

*First*, the uterine ligaments, especially the uteropelvic and uterosacral, which maintain the cervix in its normal position.

*Second*, the pelvic floor and pelvic fascia, which make up the pelvic diaphragm.

*Third*, the supporting action of the adjacent pelvic organs.

*Fourth*, the action of the intra-abdominal pressure.

And, *finally*, the axial relation of the uterus to the vagina.

The basic principle of maintaining the uterus in position is the retention of the cervix well back in the hollow of the sacrum, while the fundus rests on the pubic shelf; this depends largely on the upward and backward traction of the uterosacral ligaments, the integrity of the fascial sheets, and the upward supporting action of the pelvic floor.

*The types of prolapse.* Descensus is properly a general intrapelvic hernia. Descent of the uterus is always attended by more or less inversion of the vaginal walls and takes place along certain cleavage planes, as, for instance, the tissues may slip their (1) post-pubic attachments and allow the anterior segment of Hart, including the bladder, urethra, and anterior vaginal wall, to prolapse through the vulva introitus; or the original injury may be through the (2) vesical plate of fascia, allowing a hernial protrusion of the bladder (cystocele), or may be due to a laceration through the (3) rectovaginal sheet and the levatores ani, with consequent rectocele, or rectal prolapse, especially when the anal fascia has been included in the injury.

Enteroptosis and an increase in intra-abdominal pressure are factors that persist long after any operation is done for prolapse of the uterus, and therefore are potent causes of relapse. It must not be lost sight of, however, that descensus uteri may occur in women who have never borne children, or who have never sustained sexual relations. In procidentia, the inverted vagina becomes thickened and œdematous, and the epithelia become dry and horny, owing to the fact that the inverted vagina is the seat of a chronic venous stasis and is no longer moistened by the cervical secretion.

The continued venous stasis produces permanent tissue changes in the infravaginal portion of the cervix and in the vaginal walls, causing the cervix as a whole to be greatly elongated and thickened. The body is likewise enlarged, and the bladder is prolapsed and shows the morbid changes of chronic catarrhal inflammation of the mucosa and of inflammation of the muscular coat.

In the operative cure, therefore, we should take into consideration a study of the types of prolapse to be dealt with, for an operation which is applicable to one type may fail in another. Each case should be studied as to

[1] Read before the American Gynecological Society, Boston, May 20, 1914.

the cleavage plane of its descent, the size of the uterine body, the amount of infra- or supravaginal hypertrophy of the cervix, the extent of the vaginal inversion, the degree of the cystocele and rectocele, including the œdema and general condition of the vaginal walls, the presence or absence of adhesions, adnexal tumors, etc.; the degree of visceral ptosis and intra-abdominal pressure should also have consideration, and, finally, every patient with pelvic prolapse should be examined in the standing posture to appreciate the amount of descensus.

Interposition or transposition of the uterus may be elected in women past or near the menopause where the uterine body is small or can be sufficiently reduced in size and is not diseased by degenerative changes, and when the hypertrophy of the cervix is infravaginal and the cystocele is the chief complicating lesion, provided the prolapse has not occurred at the post-pubic cleavage plane. This may be determined by the position of the urethra and a test of its attachment to the pubis.

*The technique employed.* In our clinic the procedure employed consists —

*First*, in a high amputation of the cervix, except when the uterus is atrophic.

*Second*, in a longitudinal incision through the anterior vaginal wall from just behind the meatus to the cervix; each lateral flap is grasped by a ring forceps and the bladder stripped off from its attachment to the vaginal wall in the line of cleavage, by blunt dissection.

The separation of the bladder from its anterior, lateral, and posterior attachments, and control of all hæmorrhage by clamp and ligature, are the most important steps in this operation. The bladder is next retracted and separated from the anterior uterine wall and the front of the broad ligaments, when the vesico-uterine fold of peritoneum bulges into space between the uterus and bladder, where it is incised and the blade of the retractor inserted into the peritoneal cavity, holding the bladder upward and forward. This allows the operator to climb up the anterior face of the uterus with traction hooks and antevert the uterus under the bladder. The adnexa are now thoroughly explored and given such surgical attention as may be needed; or, if the woman is still of the child-bearing age, the tubes may be tied with fine silk and excised. With the fundus drawn well forward into forced anteversion, the anterior fold of peritoneum making the vesico-uterine pouch is sewn to the posterior surface of the uterus just above the internal os; this makes the uterus extraperitoneal.

Two chromic gut sutures are now passed from the lateral vaginal wall on one side, just posterior to the meatus, through the anterior wall of the uterus, below the level of the round ligament insertion and out through the lateral vaginal wall on the opposite side. The ends of these two sutures are clamped, drawn taut, and held up by an assistant, while the fascial layer of the anterior vaginal wall is united by a continuous suture of iodized catgut.

The mucosa is finally closed with a series of interrupted sutures of chromic gut, so as not to shorten the length of the anterior vaginal wall. Before the catgut sutures are tied, the mucosa posterior and to each side of the cervix at the vault of the vaginal fornix is denuded and a silver wire suture is passed through the area including the base of the broad ligament, across the front of the uterus and out through the base of the broad ligament of the opposite side. This, when tied, lifts the cervix upward and backward in the manner suggested by Baldwin in his plication of the anterior vaginal wall. A high perineorrhaphy completes the operation.

*The causes of morbidity.* In our early experience there was a considerable morbidity following this operation, which was largely due to our inexperience with the technique. One of the most troublesome causes of morbidity was the difficulty in securing perfect hæmostasis, resulting from the wide lateral separation of the bladder, which extended into the venous plexuses just behind the pubic rami; hæmorrhage at this point is extremely difficult to control, and, if not perfectly controlled, results in an intraligamentous hæmatoma which is very liable to become infected. Several of our cases developed a lateral parametritis, and in one the uterus was embedded in a post-operative blood-clot exudate for many months.

*Injury to the bladder.* The bladder is liable to be injured while separating it from the anterior uterine wall, unless the uterovesical ligament is located and cut early in the dissection. If this is done it is possible to separate this viscus from the uterus and front of the broad ligaments without difficulty. Fistulæ at this point heal readily when immediately sutured, and the bladder is drained with a permanent catheter.

Vesical disturbances are not uncommon following interposition. These are partly due to displacement of the bladder and the relation of the uterine fundus to the vesical neck, and are partly the result of catheterization, necessitated by the vesical spasm, which is consequent upon the irritation of the perineal sutures.

Collicystitis, trachelocystitis, and trigonitis have produced a train of annoying symptoms.

The extreme anteversion of the body has occasionally produced an angulation of the uterine canal, especially when amputation of the cervix has been omitted, with resulting hæmatometra; this complication has occurred in two women past the menopause in whom the uterus was atrophied and the cervix of a senile type. Such a uterus is normally retroverted; and when the body is brought forward and fastened to the vaginal plate under the bladder, unless the cervix has been amputated, the sound shows anteflexion, not anteversion; and adhesions of the endometrium are likely to occur at the point of flexion, causing a retention of the normal secretion, with dilatation of the uterine cavity. In our later cases we have met this by bringing the base of the broad ligaments in front of the short atrophic cervix, thus carrying it upward in the pelvis, which results in a straight anteverted uterus. Pyletitis has followed this operation as an immediate post-operative complication. The colon bacillus has been the causative factor. Injury to the vesical circulation makes the bladder more susceptible to infection. Residual urine is retained and ascending infection takes place. Proper preliminary preparation of the patient has in our later cases prevented this lesion. Preoperative tissue depletion for the reduction of œdema by the employment of posture, douches, and glyceride tamponades, etc., do much toward minimizing the venous oozing which takes place during the separation of the bladder.

Eighty-two cases individually studied make the basis of this report. All of these women were at or near the menopause at the time of operation, except four who were in the active child-bearing period; and all, save these four, who were operated while still regularly menstruating were sterilized by ligation of the tubes with silk, and excision and suture of the uterine end of the tube. These four had had very difficult previous labors, yet did not wish to be sterilized, preferring to elect section in case of subsequent pregnancy than to go through future infrapelvic deliveries. Two post-operative deaths are recorded, one from acute uræmia, the other from septic infection of an intraligamentous hæmatoma. In all, the pelvic floor was restored by a high levator myorrhaphy.

Five cases show a recurrence of the prolapse, the fundus having fallen forward through the vulvovaginal introitis, owing to stretching of the anterior vaginal wall. These patients should never have been subjected to this operation; they were errors of judgment for the following reasons: In one the uterus was too small and senile to act as a supporting bridge; in two the fundus was too large and heavy to be held in position by the atrophied fascia of the vaginal plate; in the other two the vaginal inversion was too great to be properly remedied by this operation, especially as the prolapse had originally occurred in the postpubic cleavage plane; hence, the urethra and periurethral structures, including the apex of the triangular ligament, afforded no pubic shelf on which the anteverted fundus could lie. All five of these women should have been subjected to a hysterocolpectomy. Sixty not only have an anatomical cure, but are free from all symptoms referable to the pelvis; nine others have anatomical cures, but are annoyed by pelvic symptoms referable to the bladder, lower abdomen, or vagina.

The large majority of these patients have been cystoscoped at some time subsequent to this operation, and a constant cystoscopic picture has been revealed; i.e., there has been

some infolding of the bladder base, the trigone being elevated and injected above the lateral portions of the base. Trigonitis has been present and producing some vesical irritation in nearly one-half of my cases. Instillation of twenty-five-per-cent argyrol solution has given relief in nearly all. The vesical irritability has been intractable in only three, and in these we have produced temporary relief by the topical application of strong silver nitrate solutions to the ulcerative areas in the trigone.

Two, in whom the anatomic and symptomatic result would be considered satisfactory, have had intermittent attacks of uterine distention from accumulated secretion behind an angulated cervix; these cases were referred to under possible complications.

Four are, or have been, pregnant. Of this number, one miscarried at the third month without complication. One is now at the seventh month of pregnancy and presents the following anatomic relations: The cervix is high and well back in the hollow of the sacrum; the anterior uterine wall is still attached to the vagina, but is not dragging it up, and is distinctly thickened, while the development of the gestation seems to be going on in the posterior wall and upper segment without symptomatic disturbance. The bladder seems to have adjusted itself to its new position. Unfortunately, this woman will not be confined until after this report is a matter of record.

The third patient had a grave toxæmia of pregnancy and was delivered spontaneously at six and one-half months. This patient had a very stormy pregnancy for six months, suffering from constant pain in the lower abdomen, traction on the vagina, and marked dysuria almost from the beginning of her pregnancy.

One has passed through an uneventful pregnancy and was delivered spontaneously of a living child at term. The interesting feature of this labor was that the head was low in the vagina, actually resting on the pelvic floor from the onset of labor, the lower uterine segment was stretched out over the presenting part, and the internal os was effaced before actual labor pains began. Dilatation of the external os and the vaginal introitis were almost simultaneous.

Dyspareunia has figured as a troublesome complaint among these patients. This has been especially annoying in the cases in which the entire length of the anterior uterine wall has been attached to the vaginal wall. One patient has had a persistent metrorrhagia for some months after the operation. A diagnostic curettage showed adenocarcinomatous degeneration of the body and this patient has recently been subjected to a hysterectomy.

Incidentally, I would call attention to the ease with which vaginal hysterectomy can be done after the uterus has been interposed. The operation is virtually an extraperitoneal procedure, and the enucleation may be done practically without shock.

The causes of failure have been primarily:—

*First*, errors in judgment in the selection of cases for this procedure.

*Second*, errors in technique.

*Third*, atrophic tissue changes in the reconstructed supporting structures.

*Fourth*, unrelieved intra-abdominal pressure acting in conjunction with an abnormally large pelvis, or in a pelvis of faulty inclination.

In the future, causes one, two, and four can be avoided, but the actual supporting power of the reconstructed structures can never be estimated, and tissue elasticity differs in different individuals; hence, a small proportion of cases will always relapse, no matter how skilled the operator.

From this brief study, admitting that the number of cases is too small from which to draw any general deductions, I wish to offer for your discussion the following conclusions:

*First*, that interposition operations should be limited to women at or past the menopause, with relatively small uteri, and that when the procedure is elected in those still menstruating, sterilization by tubal ligation should be done at the time of operation.

*Second*, that cases of prolapse in which the sliding takes place in the post-pubic cleavage plane are not corrected by this procedure.

*Third*, that the morbidity is wholly due to technical defects; i. e., improper preparation, imperfect hæmostasis, vesical injury, etc.

*Fourth*, that in anteverting the uterus, the anterior wall of the uterus should rest on the fascial plate just behind the pubis, and the fundus should not be brought under the arch, as excessive anterior displacement not only favors recurrence, but anteflexes the uterus and interferes with drainage.

*Fifth*, that the currettings from uteri about to be transposed should always be examined, as degeneration may occur.

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# THE BEHAVIOR OF THE ABDOMINAL CUTANEOUS REFLEXES IN ACUTE CONDITIONS WITHIN THE ABDOMEN AND PELVIS[1]

By RICHARD R. SMITH, M. D., F. A. C. S., Grand Rapids, Michigan

IN the clinical study of acute processes within the abdomen American surgeons have apparently paid but little attention to the abdominal cutaneous reflexes. The subject would seem to be worthy of study, since these reflexes are affected constantly enough when certain local conditions exist to make them, I believe, of some little aid to us.

The abdominal cutaneous reflex and its deportment in certain diseases of the nervous system is, of course, an everyday matter with neurologists, the test having a definite place in the diagnosis of certain nervous disorders. Without going into detail, they find (quoted largely from Müller and Seidelmann) that these reflexes fail or are markedly diminished on the affected side of the body in spinal and cerebral hemiplegias of various origin, and that this symptom persists even after the disappearance of the motor symptoms. They fail on both sides in multiple sclerosis, and this is an early symptom of great value. They are usually exaggerated in early cases of tabes, failing in late cases or in those that show an anæsthesia of the skin of the abdomen. The reflexes are retained in patients with spastic paralysis until a late stage is reached, and is a point of differential diagnosis between this disease and multiple sclerosis. In all nervous diseases in which there is increased abdominal tension they are diminished or lacking. Hysteria does not abolish them, even when anæsthesia of the skin of the abdomen exists. They have been used also in the localization of spinal injuries.

Little literature exists, however, regarding this reflex in connection with local conditions within the abdomen, though European internists have interested themselves in the matter to some considerable extent. References to all publications that I could find have been placed in the bibliography, and some of them are here briefly reviewed.

Rosenbach (according to Rolleston), in 1876, was the first to call attention to the importance of this reflex in clinical medicine, and it has been frequently alluded to as "Rosenbach's sign."

Bodon (in 1898) called attention to it in inflammatory conditions within the pelvis. He found as a rule that pelvic cellulitis does not affect the reflex, while with pelvic peritonitis it was lost or diminsihed on the diseased side. He thought the primary nature and source of the inflammatory trouble might in some cases be thus distinguished, or at least the diagnosis strengthened. His opinions were based upon a study of nearly 300 women.

Probably the first published studies of this reflex in acute abdominal diseases was by Jamin in 1904. He particularly emphasized the loss or impairment of the reflex on the right side of the abdomen in "perityphlitis," and states that the test is here of particular value because we are dealing mostly with healthy young individuals, with active reflexes. He noted also a disturbance of the reflex in "gall-stone colic," cholecystitis, and "acute swelling of the liver."

Rolleston, in 45 cases of undoubted typhoid fever, found the reflex diminished or lost in 42. Of these the reflex was completely lost in 31

[1] Read at the meeting of the American Gynecological Society, Boston, May 21, 1914.

and impaired to a greater or less degree in eleven.

Sicard, in 26 cases of typhoid fever in older children, also found a marked diminution or absence of the abdominal reflex in 22. In two the involvement was transitory and in two the reflexes were not affected at all. He concludes that the abdominal cutaneous reflexes are affected at some time in the course of practically every case of typhoid fever, the most frequent point of involvement being the right lower quadrant.

Müller and Seidelmann, in a very comprehensive article on the abdominal cutaneous reflexes (one that is well worth reading), comment upon its behavior in acute surgical conditions within the abdomen. They say that one may regard it as a fundamental law that all diffuse or local diseased processes which take place within the abdomen and which cause a limited or general increase of tension of the abdominal musculature either weaken or prevent all or some of the abdominal cutaneous reflexes for the time that such increase of tension lasts. In distentions of the abdomen which take place slowly through chronic disease and are but little painful, they are usually not disturbed; for example, those due to circulatory disturbances, cancer, or chronic tuberculosis. The same holds true with small ovarian tumors and in pregnancy that is not too far advanced. In œdema of the abdominal walls caused by heart or kidney affections, and in intense, lasting overdistention, they are sometimes weakened, though by no means always so. After evacuation by puncture of a large amount of ascites, and the consequent relaxation of the walls, the reflexes previously present may sometimes temporarily disappear. In affections in which the distention takes place more rapidly, the abdomen is painful, and rigidity is present, the reflexes are commonly lost, as with acute peritonitis or painful meteorism, and frequently in typhoid fever. A one-sided and, therefore, significant disappearance of the cutaneous reflex is seen very commonly in localized acute inflammatory affections such as cause rigidity and circumscribed tenderness over the involved organ. They believe that under such circumstances the loss of the reflex is always accompanied by rigidity, and that the increased muscle tension simply covers or abolishes temporarily the normal response. They agree with Jarmin that the testing of the abdominal cutaneous reflex in the diagnosis of appendicitis has a certain value. They lay much emphasis on the technic employed in order to obtain reliable results.

The statements made in regard to the abdominal cutaneous reflexes have been in the main true. There has been, however, to my knowledge no series of observations published from which we might make a closer study of the question, and it was with the idea of doing this that I began two years ago to note the response of the reflexes in some of our abdominal cases. Since that time, besides a considerable number of informal observations, I have recorded in 175 cases (mostly of acute diseases) the reflexes before operation and the condition met with at operation which followed soon after.

The abdominal cutaneous reflex may be obtained in practically all healthy individuals of both sexes, with certain exceptions that must constantly be borne in mind. It is uncertain (it is said) in children under three years of age, but is very active during childhood and adult life. As life advances it gradually becomes weaker or is lost, though exceptions even in individuals over sixty are plentiful. In those with obese abdominal walls it is common to see it weak or absent, and the same is true of those whose walls for any reason are relaxed, the most frequent cause being childbearing. Negative or weak responses in such individuals as constitute these exceptions, unless the difference in a certain section or in sections is very clear, therefore, means but little. Positive findings, however, have their usual value. I think this is a point to be especially emphasized.

A word as to the physiology. The centripetal impulses pass through the posterior horns of the eighth to the twelfth dorsal nerves, thence along the posterior columns to the superior pyramidal decussation and through the middle lemniscus to the motor cortex of the opposite side, thence centrifugally along the pyramidal tracts to the cells in the an-

terior horn of the last four dorsal segments. This arrangement, common to the other skin reflexes, explains its behavior in lesions affecting the higher centers. The reflex is apparently one of the body defences, its object being to protect the abdominal organs against injury by instantly making rigid the walls when threatened from without.

The testing of the reflexes is very simple, takes but a moment, and needs no apparatus — points of practical importance. Care is, however, necessary in order to obtain reliable results, a fact emphasized by various writers. The abdomen may be divided into quadrants, an upper and lower one on either side. Neurologists have sometimes made a division of six, three on either side, but four would seem more practical in testing for local conditions. I employ any kind of a dull instrument, usually the blunt end of a pencil. If this fails, I sometimes use a pin drawn lightly over the skin. The stroke should be full, rather light, and not too swift. It is applied in an oblique direction, parallel with the line of the groin and the edge of the ribs. The first stroke is apt to give the strongest response; after that it usually weakens or is entirely lost, a point of importance when the reflexes are weak. One must be careful not to encroach upon territory supplied by another reflex. If the reflex is present, an almost simultaneous contraction of the oblique muscles or rectus (or both) takes place, which when well marked will pull the umbilicus to the side that is being tested. When weak only a fleeting and slight depression of the wall is produced. One must see that the muscles are not wilfully put on tension, as it may weaken or destroy the response. Again, if the stroke causes pain, a voluntary contraction is apt to take place on that side of the abdomen or body, which, however, distinctly follows the stroke but this will not deceive one if he is on his guard. Movements of the fat must not be confused with muscle contraction, an easy source of error in some cases.

As stated above, the reflex is a very constant one in healthy young individuals, fully as much so as the tendon reflexes. Müller and Seidelmann, examining one thousand healthy young soldiers, found the cutaneous reflexes always present with but one exception. They were all stripped and examined in the standing position, and were stroked with the blunt end of a pencil (rarely the point of the pencil was necessary). They found no great difference between the right and the left side under the same technique. The same obtained in two thousand healthy young women with normal abdominal walls and apparently intact abdominal organs, examined in the ambulatorium of their clinic. Even with fat or relaxed walls (for instance, after repeated childbearing) the reflexes seldom failed, although they were often weakened and hard to obtain. It is well to bear in mind that they tested their subjects in a standing position. It is obviously impossible to test patients suffering from any of the diseases under discussion in this way. I have sometimes found in young healthy individuals the reflex weak or lacking in this or that quadrant without assignable cause; this is, however, exceptional.

The largest group in which we have made this test has naturally been that of appendicitis cases. We made note of the reflexes in 86 patients with this disease; eleven of these were chronic. In the eleven chronic cases here noted there was some involvement of the reflexes in five: three were women who had borne children; one was a man with very obese abdominal walls who had entirely negative reflexes; and in one case (a woman) there was a negative reflex in the right lower quadrant, for reasons unknown. Except in the last instance, then, these reflexes acted within their ordinary limitations. This does not represent the total number of cases operated during the same period, but I have found the reflex so little affected in our chronic cases that we made no further record of it.

There were 75 cases of acute appendicitis, with involvement of the reflex in 65; in ten the reflexes were not involved. The latter are instructive; three of them were boys, with rigidity and a well marked acute appendicitis. In children these reflexes are ordinarily very active, and we have learned to be cautious and not to place too much stress upon their presence in such individuals even with well

outspoken lesions. It is not improbable that in these cases there was a comparative diminution. One of these boys, at least, left the hospital with exceedingly active reflexes, although they were but mildly present at the time of operation. In this group of exceptions were six men with a well marked appendicitis; four with rigidity, and two in which this latter symptom was not recorded. They all had active reflexes without the distinct differences to which alone we may attach importance under such circumstances, and they must be regarded as exceptions.

In the other 65 acute cases, (56 under 40 years of age,) the reflexes were more or less involved. In 53 of them rigidity was recorded as also present. In seven the state of tension was not recorded, but we may assume that in some of these at least it was present. In five the reflexes were involved, although there was no rigidity. The relationship of diminished or lost reflexes to rigidity is interesting. The two are so often present at the same time as to give rise to the opinion expressed by Müller and Seidelmann that physiologically the reflex is simply covered by the constant muscular tension present. Closer investigation, however, does not always bear this out. We find that although rigidity may be almost universally present over the abdomen, the involvement of the reflex is frequently limited to the area over the lesions. Also, with no rigidity, that involved reflexes are not very uncommon under such circumstances.

The involvement consisted in a loss or occasionally a marked diminution, as compared with the others, of the reflex of the right lower quadrant. Very frequently the involvement extended to some or even all of the others.

The extent to which the reflex is involved is significant. An involvement of the reflex of the right lower quadrant has almost always denoted a fairly well localized inflammatory process. With further involvement, that is, an absence of the reflex of the upper right or lower left quadrant, the inflammation may yet be fairly well circumscribed. But when all are involved we have almost invariably found a considerable extension from the original seat of trouble. In all severe extensions of the inflammatory process, the condition commonly designated as "general peritonitis," all the reflexes have invariably been absent. When other symptoms of appendicitis have been definite and we have found little involvement of the reflex, we have occasionally found the reason for the same on opening the abdomen. In such cases there has been slight or no involvement of the peritoneum. The appendicitis has been very mild or the appendix has been found to the outer side and underneath the cæcum, or well down in the pelvis. The prognosis in any given case of appendicitis is affected principally by the pulse, condition of the circulation, and the local symptoms present. Among the latter the extent of the involvement of the reflexes is important and may with limitations be depended upon.

We have noted the reflex in six acute gall-bladder cases. In these there were no stones present, but there was a more or less active state of inflammation. In five of the six rigidity was present and the reflex of the right upper quadrant was involved. In the chronic cases, with or without stones of which we have, however, but formally noted five, we found no involvement that could not be accounted for by age or by flaccid or obese walls. In a number of cases of acute cholecystitis (unoperated) we commonly found the upper right quadrant involved, although no record has been made of these, since they were not verified by operation.

We noted the reflexes in ten cases of pelvic inflammatory disease that were more or less acute in character and with pus present in all. None of these, of course, was acute in the sense that we speak of acute appendicitis, but all were cases that were not subsiding satisfactorily and could not be called chronic. In one other case which had positive reflexes there was a subacute exacerbation of an old chronic condition, in which pus was found. In our more chronic cases, in which record was not always kept, there was none in which the reflexes were absent. The involvement in these pelvic cases was quite uniformly in the lower quadrant on both sides. In women who have not borne chil-

dren the disappearance of the reflex would have significance, but it cannot be used, I believe, to distinguish a pelvic inflammation from an appendicitis. The group is too small to warrant further conclusions.

Our group of ectopic cases, 13 in number, is too small for any very definite conclusions. Five of these women had borne children, and for this reason little stress could be placed upon the involved reflexes. In one with rigid and distended abdomen the reflexes were also mildly present and in all the remaining cases the reflexes were normal. I am under the impression from this meagre observation that an effusion of blood into the pelvis and lower abdomen seldom affects the reflexes, or is less likely to do so than an inflammatory process.

We have had four cases of perforated gastric or duodenal ulcer (all men) with marked abdominal rigidity in which the reflexes were totally lost, except in one case where they were very slightly present in the lower quadrant when seen three hours after the onset of symptoms. Seven hours later the absence of the reflexes was general.

We have had twelve cases of acute obstruction of the bowel, a group so small as not to warrant very definite conclusions. The reflexes were uninvolved in seven, in four no stress could be placed upon the loss or diminution because of age or relaxation. In one, a boy of seven, there was total loss of reflex, but this must be regarded as an exception. We may tentatively conclude from these few cases that obstruction of the bowel commonly does not affect the reflexes.

We have also had a large group of miscellaneous cases, many of which were acute or subacute in character and in which we found that the reflex varied. We have been fairly safe in estimating when the reflexes were present, with no abdominal rigidity, that no very acute process invading the peritoneum was present. Collections of pus outside of the peritoneum were almost uniformly attended by normal reflexes.

Our observations have led us to the conclusion that the abdominal cutaneous reflex has a distinct, though limited, value in acute conditions within the abdomen and that, although perhaps not as valuable a sign as rigidity (or lack of it), when combined with other symptoms, it is of value in strengthening our diagnosis.

In younger people, with intact abdominal walls, since these reflexes are so constantly present, their involvement has a particular significance. In older individuals, or those with obese or relaxed walls, conditions, of course, frequently met with, the presence of reflexes has a far greater significance than their absence, and we have learned to place but little stress upon such absence in these patients. To be of value to the surgeon he must not only develop a uniform and careful technique, but must study the matter to some extent in order to make it of practical value in diagnosis. To place too much value upon it would lead to frequent error, as is the case with most of our diagnostic signs.

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# ERUPTIONS FOLLOWING OPERATION

By FRANKLIN B. McCARTY, M. D., Chicago

CUTANEOUS eruptions, localized or general, are frequently observed during the administration of ether. Such eruptions are usually transient and disappear before consciousness returns. There occurs, however, a later and more persistent post-operative eruption in some cases, and this takes on a very definite character, often simulating one of the exanthemata.

A series of one thousand consecutive operative cases at the Free Hospital for Women, Brookline, Massachusetts, was observed with this point in view. In every case ether was the anæsthetic employed; the ether was of standard manufacture and contained four per cent of ethyl alcohol and none of the ordinary impurities of ether — acetic acid, sulphuric acid, hydrogen peroxide, or aldehyde.

The changes produced in the body by etherization may be briefly summarized: The blood shows a polycythemia or, rarely, an oligocythemia with increased specific gravity, these changes being most marked immediately after etherization.

The amount of hæmoglobin is unchanged or slightly reduced, varying with the amount of ether used and the duration of anæsthesia, and there is a temporary diminution in the supply of oxygen and retardation in the elimination of carbon dioxide.

Hammersten has shown that there is some tendency toward hæmolysis due to actual dissolution of lipoids in the investing membrane of the red cells, but spectroscopic examination of the urine shows no increase in urobilin.

Various statements have been made as to the effect on the leucocytes in operative cases with normal convalescence. Cabot found no change in leucocyte count which could be attributed to etherization, and in a series of 36 cases reported by Cabot, Blake, and Hubbard, there was in 11 cases a leucocytosis ranging from 19,000 to 27,000, this increase being attributed by them to the type of operation rather than to the influence of ether.

White found an increase to 21,000 with a relative and absolute polynuclear leucocytosis after operation, the count being highest five hours after operation and gradually approaching normal, which is reached in about five days.

Blood-pressure shows no change other than a slight and transitory decrease immediately after operation. Bovée found that the amount of urine secreted showed little change after the first hour, although some reduction was noted in patients operated in the Trendelenburg position, due partly to retention of urine in the renal pelvis and partly to arrest of function from the position.

The amount of urea excreted is decreased during the first twenty-four hours and increased during the following two days.

The production of albumin has been the subject of considerable discussion, but the opinion seems to prevail that albuminuria occurring in a patient without previous renal disturbance is unusual.

Eruptions occurring during etherization are mentioned in some of the textbooks on anæsthesia, but the post-operative eruption receives less notice. It is mentioned by some of the earlier writers and apparently was of more frequent occurrence then than now, due probably either to impurities in the ether or to more frequent occurrence of sepsis. Lawson Tait described an urticarial eruption which occurred after operation and seemed to be commonly associated with various degrees of wound sepsis, but which was also found after such procedures as paracentesis, opening of an abcess, ovariotomy, and other cases of abdominal section.

Atchinson in 1886 described a series of cases in which a similar condition occurred. Probyn and Williams state that "ether rash may occur in any patient, more often in women and children. It appears, as a rule, just as the patient

is becoming comatose and takes the form of an erythema which occurs most frequently on the neck and shoulders, but may spread to the chest and abdomen and even to the thighs. It is accompanied with profuse sweating and generally lasts less than ten minutes. When seen for the first time it suggests, to the uninitiated, measles or scarlet fever." Buxton states that this rash has probably no significance beyond showing the action of ether upon the sympathetic system.

Gottheil describes as erythema simplex a condition occurring after operation in which are found pea-sized spots distributed generally over the body and not accompanied by any rise in temperature. Stelwagon mentions surgical operations, particularly those in the abdominal cavity, as a rare cause in urticaria, probably due to the accompanying profound nervous disturbance. There is described by several writers on skin diseases a condition known as erythema scarlatiniforme, first described by Hardy, which occurs after operation, after injuries, and after the use of certain drugs, as mercury and iodoform. The lesions vary from a localized eruption to a general or almost continuous one, and from an insignificant or absent constitutional disturbance to that of a severe degree with high temperature. The eruption is usually scarlatinous, occasionally morbilliform, and the color varies from bright pink or red to a sluggish or livid red. It is ushered in with the ordinary symptoms of mild febrile disease, with the development of skin redness at the same time or several hours later, the constitutional symptoms commonly abating with the appearance of the eruption. The eruption begins to abate in one to four days and is almost always followed by some desquamation, in some cases scarcely perceptible, the whole course of the process occupying one to four weeks. Hoffa in his monograph divided eruptions following operations into four classes:

*First.* Purely vasomotor disturbances due to irritation of sensory nerves, and occasionally after operation upon parts abundantly supplied with nerves. This sort of eruption appears a few hours after operation as an erythema or urticaria, and disappears very rapidly. Cases of puerperal scarlet fever are included in this class.

*Second.* Toxic erythema due to absorption of secretions and aseptic material from the wound, or to the absorption of carbolic acid, iodoform, or corrosive sublimate, or to the effect of ether. Such cases are analogous to the medicinal eruptions and appear without prodromal symptoms about twenty-four to forty-eight hours after operation. They occur even with simple fracture, and Lichthein reports a similar condition found in animals which have been recently transfused.

The eruption appears as a diffused redness or as isolated large patches with comparatively clear intervals, involves only the body and extremities, and disappears in twenty-four hours without any subsequent desquamation.

There is usually marked febrile reaction, and in children delirium or coma may occur, gastric symptoms often being very prominent. This form is supposed to be due to absorption of secretions of the wound or of particles of tissue or fibrin ferment, such as occurs in aseptic fever, although in the same class is included the erythema due to ether alone, in which no such absorption could occur.

*Third.* Infectious eruption due to capillary emboli formed of clumps of micrococci and found in general infections, as septicæmia and pyæmia. The eruption is more marked than in the toxic variety, usually takes the form of an urticaria or erythema, and may become pustular or hæmorrhagic. It may be isolated or diffuse and may closely simulate scarlatina, being followed in many cases by more or less desquamation.

*Fourth.* True scarlet fever — a communicable condition believed by some to be a mere coincidence and by others to be due to increased susceptibility due to the shock accompanying a wound, burn, or operation. This is especially frequent in children; incubation is brief; the eruption is atypical and is followed by desquamation. McCollom holds that the condition is merely a coincidence, stating that in a patient who has had recurrent attacks of appendicitis the presence of an undetected scarlet fever in its incubation stage may stir up acute appendiceal symptoms and cause the surgeon to decide to operate.

The scarlet fever eruption appearing a day or two later would be called a surgical scarlet fever.

In a series of one thousand consecutive operative cases at the Free Hospital for Women, in all of which ether was the anæsthetic used, there were 43 eruptions. This does not include the transient eruptions seen during etherization, and in every case there was a definite interval of hours or days between the operation and the onset of the eruption. In 41 of the cases there was no other complication than the eruption, the other two cases showing mild wound sepsis.

In no case were there any prodromal symptoms, and the eruption appeared suddenly some time after operation, and was accompanied from the first by marked itching. It varied in character, some cases showing a general pink erythema, some a fine papular eruption which blanched on pressure, and the more marked cases definite, well-marked papules, small to the size of a pea, discrete or crowded together, and in places coalescent, forming larger, dark, irregular patches, especially over the bony prominences. The cases could be divided into two classes: those appearing within twenty-four to forty-eight hours of operation and those with a later onset, the latter following a more definite course. The cases with an early onset appeared as an eruption on the upper half of the body, beginning either on face, chest, or arms and rapidly involving the abdomen and legs. The face was involved in almost every instance, and the eruption varied from an erythema of brief duration to a papular eruption lasting several days, itching being quite marked, especially at first. There was no systemic disturbance and the temperature was elevated, but less so than in the cases with later onset.

CASE. Mrs. C., age 27; housewife; no history of previous eruption. *Operation*, April 24, 1913; repair complete laceration of perineum; ether anæsthesia. April 25. Fine, discrete, papular eruption appeared on arms and chest and spread rapidly all over the body, including the face; marked itching. Temperature: (morning), 99° F.; (evening), 100.2° F.; leucocyte count, 11,000. Eruption increased for next twenty-four hours and then began to subside. Temperature remained elevated to 100.2° F. until April 29, when eruption had faded; no desquamation. May 1. Skin clear; temperature, 98.6° F.; leucocyte count, 8,000.

Patient received no enemata or cathartic for nine days after operation.

The second class of cases had a sudden onset, three or more days after operation, without prodromata but with a temperature which had continued higher than would be expected after operation. The condition varied in severity from those in which only a part of the body was affected to those in which the eruption was almost continuous over the entire surface. The condition began as an erythematous or fine papular eruption located at first on the inner surfaces of forearms and thighs, and extending over the entire body, rarely affecting the face and never involving the palms or soles. It was accompanied by some itching, which increased as the lesions extended and persisted until fading occurred. The papules were at first pink and later dark red, and the eruption reached its height in twenty-four to thirty-six hours, after which it began to subside and itching became much less marked. The onset occurred as late as seven days after operation, and the condition lasted from one to seven days, the average being about four days, although some traces of the fading lesions appeared for two or three days more in many cases. It was noted that those cases in which the onset was delayed longest were of briefest duration, and those cases which began on the third or fourth day after operation were of longest duration and greatest severity. Desquamation was not observed in any case.

CASE. Miss B., age 34. *Operation*, May 21, 1913; dilatation and curettage; appendectomy; anterior fixation of round ligaments. May 24. Temperature has varied from 100° to 100.6° F. in evening since operation; leucocyte count, 12,000; wound clean, no distention. May 25. Papular eruption on inner sides of arms; some itching. Temperature, 99.6°; leucocyte count, 12,000. May 26. Eruption all over body, less marked on face than elsewhere. Papules coalescent, forming dark red patches over knees, elbows, and sacrum. No symptoms except itching. May 27. Eruption beginning to fade; arms and face clear; still marked on back and body; itching intense. Temperature, 99.6°; leucocyte count, 9,000. May 29. Eruption fading rapidly; no itching.

The temperature remained elevated before eruption appeared and until fading began, and in some cases this rise in temperature was quite marked while in others there was no change from the normal. The average increase was about one-half degree above that of an uncomplicated convalescence. The average temperature of a series of forty cases with an uncomplicated convalescence was compared with that of a series of forty cases in which an eruption but no other surgical complication had occurred, and it was found that the temperature in the uncomplicated cases became normal on the morning of the second day and did not exceed 99° F. in the evening after the third day. In the cases with eruption there was an elevation of evening temperature above 99° F. until the eighth day, that time corresponding to the disappearance of the eruption. The pulse was affected but little, remaining proportionate to the temperature and rarely rising above ninety.

The leucocyte count was taken daily after the appearance of the eruption, in sixteen cases. Leucocyte counts were also taken in sixteen cases on whom similar operations were performed and who had uncomplicated convalescence, these counts being made before operation and repeated after operation until they coincided with that taken previously. In the uncomplicated cases the count reached normal on the fourth day after operation, and in five cases there was no increase in leucocytes at any time, this being the same proportion of cases without leucocytosis as was reported by Cabot. In the cases with eruption, the average count on the fourth and fifth days, the time corresponding to the height of eruption, was 14,000, or nearly double that of the uncomplicated cases at the same time. After the fifth day the count fell rapidly to normal. Smear showed the increase to be polynuclear, and there was no change in red-cells.

Urinalysis was made in every case before and after operation, and no albuminuria or acetonuria was found, nor were casts detected in any case which had not shown casts previously.

The patients varied in age from twenty-two to sixty years, and the operations in all but three instances involved the pelvic organs. The severity of operation or duration of anæsthesia apparently had no bearing on the production of eruption, for the operations included simple curettage, appendectomy, plastics, hysterectomy, and ventral hernia. The amount of ether required to maintain anæsthesia varied, some requiring but little and others a relatively large amount. Nearly all were operated in the Trendelenburg position.

Two patients gave a history of previous eruptions, one following operation for procidentia and the other following parturition. Eight cases had been operated upon elsewhere and none had any recollection of any eruption. One had been operated upon at the Free Hospital for Women and had no eruption, the previous operation being a dilatation and curettage and the second operation a laparotomy. Five cases were operated subsequently at the Free Hospital for Women and none developed any eruption, although preparation and post-operative treatment were the same and in two instances the second operations were longer and more extensive. One patient had been operated previously for exophthalmic goiter, the exophthalmos persisting slightly, and one was of a highly nervous type and flushed easily. In both cases eruption appeared within twenty-four hours.

Two cases showed surgical complications — one a small subfacial hæmatoma in the abdominal wound which discharged after several days, and the other a mildly septic abdominal wound which later discharged a linen suture from the fascia. Four cases were drained for anticipated serous exudation due to large raw surface; three of these were large ventral herniæ and the fourth was a complete hysterectomy with vaginal drainage. Aside from these, the wounds united by primary intention, and convalescence was uneventful in every respect save for the eruption.

Preliminary preparation for operation varied somewhat as regards catharsis. Castor oil, calomel, and magnesium sulphate were employed, and all cases received cleansing enemata containing turpentine the night before operation. Atropine gr. $^1/_{150}$ was given

subcutaneously before etherization, as a routine. Post-operative catharsis consisted in most cases of calomel gr. $\frac{1}{20}$ ss in divided doses the night of operation, followed in the morning by magnesium sulphate ℥ ss. Pil. rhei comp. were used as required after the second day. Some cases received only Seidlitz powder after operation, and one case received no cathartics or enemata for nine days.

Opel has reported cases of general eruption occurring in definite relationship to menstruation. Such an eruption has been designated as erythema pudoris, and has been noted during pregnancy and at the catemenia. Fox believes it to be due to subacute ovarian or uterine irritation acting on a naturally sensitive nervous system. Frank quotes a case in which removal of a chronically inflamed left tube and ovary resulted in cure. Of the cases observed, five had passed the menopause, one had never had any catamenia, seven were in the premenstrual stage, seven in the interval, five in the post-menstrual, and one was menstruating at the time of operation; so that in these cases there was no relation between eruption and menstrual epoch.

Eruptions similar to those observed have been ascribed to many causes by different writers, calomel, magnesium sulphate, morphine, atropine, turpentine, resin, nitrous oxide, chloroform, ether, enemata, and meteorological influences all having been considered the cause at one time or another. Eruptions due to mercury, either internally by calomel or externally by bichloride, are erythematous or punctate, general in distribution, with mild or severe constitutional symptoms, nausea, and vomiting, and commonly show lesions of the buccal mucosa.

Morphine shows an erythematous or scarlatiniform eruption with intense itching, tendency to nausea, and contracted pupils.

Atropine may produce even in very small doses a scarlatiniform or patchy erythematous eruption appearing within twenty-four hours and accompanied by intense itching. The peculiar blushing of the face, dryness of mouth, and dilated pupils suffice to differentiate it.

All of the eruptions due to drugs appear within a few hours or a day of administration, whereas many of the eruptions after operation are delayed in onset for three or more days.

Climatic conditions have been claimed to have a large influence; and disturbance of circulation, due to exposure to cold, east wind, and changeable temperature have been held responsible for the condition. The occurrence of several cases within a day or two with considerable intervals was quite marked in this series, but barometric readings and amount of precipitation seemed to show no constant feature that might be associated with the condition.

Enemata as an etiological factor have been mentioned by Crawford, Still, and Shepherd, the former not accounting for its occurrence other than to assume that the eruption is due to the absorption of morbid products following the use of enemata — as after the use of enemata following the operation for appendicitis. Shepherd found in his cases that eruption occurred most often in patients who had been given enemata of soapsuds and water, in the preparation of which common yellow soap had been used. When Castile soap was substituted for yellow soap, the percentage of eruptions diminished considerably, and he concluded that the effect was produced by resin contained in the yellow soap. He cites one case in which eruption followed the use of the yellow soap enema repeatedly and in whom no eruption occurred after the use of Castile soap enema; but on again using yellow soap the eruption promptly appeared. He was at first inclined to attribute the condition to turpentine used in the enemata, but omission of turpentine caused no diminution in the frequency with which the eruption appeared. Two kinds of eruption were observed in his cases: a very itchy scarlatiniform eruption followed by desquamation, and a general papular eruption appearing later. In one case observed at the Boston City Hospital in which a general papular eruption followed immediately after enema in a post-operative case, the condition seemed to be due to irritation of the enema rather than to any ingredient, as a fresh eruption followed each enema regardless of

composition, both milk-and-molasses and soap-suds-and-glycerine enemata having been used.

The etiology of these eruptions after operation is very obscure and various factors probably contribute to their production. There is found in every case some particular immediate cause, and this may vary from the shock of operation to the mechanical irritation incident to the use of enemata. In addition to this there is the factor of individual idiosyncrasy, which so affects the individual that conditions which ordinarily produce no change become noxious and cause pathological change. And, finally, there is the factor of nervous suceptibility; that this is a considerable factor is evidenced by the fact that nearly five per cent of all cases operated in a gynecological service showed a definite eruption, a much larger percentage probably than would be found in a general surgical service. This is due in all probability to the fact that in most cases operation involved the pelvic organs, which are abundantly supplied with nerve fibers from the sympathetic system. In accord with this idea is a case which has been reported in which the passing of a uterine sound caused eruption, and a recurrence of the eruption appeared after each of fifteen similar procedures on the same patient. It has long been recognized that there is some association between the pelvic organs and the peripheral vasomotor system, probably through the sympathetic system, and vasomotor erythemas, simple rosacea, and acne rosacea are found five times as commonly in women as in men. One patient in this series gave a history of eruption following delivery five years previous. The delivery was entirely normal and no ether was given, nor were enemata used. On the day before operation a general papular eruption appeared and persisted all day, having nearly disappeared the next morning. No enemata had been given up to the time the eruption appeared. Four days after operation a severe papular eruption with intense itching appeared and persisted four days.

There is no doubt that ether alone furnishes the stimulus which produces some of the eruptions, particularly those appearing very soon, but it cannot be regarded as the sole cause, for in some reported cases nitrous oxide or chloroform were used as anæsthetics instead of ether. Absorption of wound secretion has been considered a frequent cause, and the presence of a slight leucocytosis and increased temperature might be attributed to undiscovered sepsis or to absorption of secretions such as is found in aseptic fever. Schnitzler and Ewald maintain that this latter condition is due not to fibrin ferment or to nervous shock, as is usually asserted, but to the presence in the blood of nucleins and albumoses which are set free by the traumatism. If absorption were the cause, one would expect the eruption to follow all types of operation with equal frequency and would expect to find some elevation of temperature and leucocytosis in every case. Some of the cases showed no change in either temperature or blood count. It also fails to explain the eruptions after enemata and after simple etherization.

In general, it seems likely that the most important factor is the nervous shock produced by operation, acting as a stimulus to the sympathetic system and so producing vasomotor disturbance. The cases where eruption follows simple enemata, etherization, or minor surgical procedures are due to this same factor acting upon an individual whose nervous system is peculiarly susceptible to such influences.

## CONCLUSIONS

1. Eruptions following operation are of comparatively frequent occurrence, particularly after operations upon parts abundantly supplied with sympathetic nerve fibers, as the pelvic organs, where they occurred in four and one-half per cent of a series of 1,000 cases.

2. These eruptions occur after any of the common anæsthetics — ether, chloroform, or nitrous oxide.

3. The condition is characterized by an interval between operation and onset of eruption, by lack of prodromata or of constitutional symptoms, by the presence of an erythematous or papular eruption with severe itching, and by the presence of an elevated temperature and moderate leucocytosis.

4. The eruption often simulates scarlatina, measles, and the so-called drug exanthems.

5. The exciting cause varies: drugs, enemata, anæsthetics, and operative shock are included.

6. The underlying cause is a vasomotor disturbance due probably to irritation of the sympathetic nervous system.

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# CAN SURGERY BE ELIMINATED IN THE TREATMENT OF FIBROID TUMORS OF THE UTERUS?[1]

By JOHN A. McGLINN, A. B., M. D., Philadelphia

IF the query propounded in the title of this contribution were put to a vote of this society, I believe that the verdict would be that the paper could be completed in one word — "No." Unfortunately, there is developing, in the profession at large, a more or less general belief that all fibroid tumors of the uterus can be cured, with less danger to the patient, by röntgenotherapy than by surgical procedures. On account of this growing opinion, I deem it not amiss to bring the subject before this society in the hope that the seal of its authoritative approval will be placed upon surgery as the proper treatment of these tumors unless, for certain definite reasons, such treatment is contraindicated in a given case.

That röntgenotherapy has a place, and a very important one, in the treatment of myomas is not to be denied; but I hope to prove that there is no justification for the view that surgery should be entirely supplanted. It may be stated in passing that this opinion is not held by leaders of American surgery and röntgenology. In the preparation of this paper, letters embodying a series of questions were sent to one hundred of our best-known surgeons and gynecologists and to a like number of the members of the American Röntgen Ray Society. Replies were received from forty-four surgeons and gynecologists, and in reply to the question, "Do you believe that all cases of fibroid tumors of the uterus (not including the submucous) should be treated by the X-rays?" all answered in the negative. The same question was propounded to the röntgenologists and out of sixty-two answers received, nine answered in the affirmative, twenty-five in the negative, and twenty-eight, on account of lack of experience with the method, expressed no opinion. Of the nine who answered yes, two so qualified their answer that they should really be counted among the nega ive. A close study of the

[1] Read at the Thirty-ninth Annual Meeting of The American Gynecological Society, Boston, Massachusetts, May, 1914.

voluminous literature of this subject gives no justification for the view that the X-ray is preferable to surgery in the treatment of all cases of uterine fibroids. Inferentially, however, many of the papers published do express this opinion, and as a result this view is being generally accepted as true.

In the beginning it may be well to discuss the relative value of the two methods as to cure. A cure, I take it, means not only the relief of symptoms, but the complete removal of the tumor. The results of röntgenotherapy have been reported by Mohr, who gives an analysis of 796 cases so treated, with known results in 669. Of these, he reports as cured 376, or 56.2 per cent; improved, 208, or 31.1 per cent; unimproved, 74, or 11.1 per cent; relapsed, 7, or 1.0 per cent; dead, 2, or 0.29 per cent. Of 380 cases studied from the standpoint of reduction in size, 81, or 21.3 per cent, were unchanged; 219, or 56.6 per cent, showed a slight decrease; 52, or 13.7 per cent, were considerably reduced; 20, or 5.3 per cent, entirely disappeared; in 3, or 0.8 per cent, there were subjective sensations that the abdomen had become smaller; in 5, or 1.3 per cent, the tumors increased in size. If we study this report, we will note that while the claim is made that 56.2 per cent of the tumors were cured with a mortality of but 0.29 per cent, in reality but 20, or 5.3 per cent, were completely cured.

What can surgery show as to cure? I believe it must be admitted that, except in those cases which die as the result of the operation or are not cured on account of recurring malignant disease, hysterectomy cures all cases permanently. Hysterectomy, however, is not without its dangers. Hysterectomy for uterine fibroids has a definite mortality which varies, it is true, with the skill of the individual operator as to his technique and selection of his cases. One of the questions asked the surgeons was, "What do you consider an average mortality in the surgical treatment (hysterectomy) of fibroid tumors of the uterus?" The answers indicated an average of 2 per cent. A study of the reports of twenty-one Philadelphia hospitals for one year showed records of 494 cases treated by hysterectomy, with 17 deaths, a mortality of 3.8 per cent. This, I take it, is a fair average mortality, though practically all the papers on the value of röntgenotherapy place the surgical mortality at 5 per cent.

The following question was also asked the surgeons: "In what percentage of your cases have you found malignant degeneration?" The replies varied from 1 to 10 per cent, and the combined figures would indicate an average of about 5 per cent. The röntgenologists quoting from previously reported papers by Noble, McDonald, and others, place the frequency at 2 per cent.

Now, if we accept the high primary mortality of 5 per cent and the low percentage of 2 for malignant degeneration, and admit, for the sake of argument, that no case of malignant degeneration is cured by surgery, we have as the result of hysterectomy 93 per cent of absolute cures as against 5.3 per cent for röntgenotherapy. This conclusion may be criticised on the ground that we should accept as cured by röntgenotherapy the first published figures of 56.2 per cent. Even admitting these figures, there is no comparison as to the value of the two methods. What right have we, however, to assume that the 94.7 per cent of the tumors which were not removed will not at some future time take on such various degenerations and complications as will ultimately destroy the host? The trouble has been that only the relative immediate mortality of the two methods has been compared, and not the ultimate results.

It must be admitted that the immediate mortality of hysterectomy is higher than that of röntgenotherapy. In spite of this, however, we must take this extra hazard, as we are not justified at the present time in discarding a certainty for an uncertainty.

Is the use of the X-ray treatment without danger? One of the questions asked the röntgenologists was: "What, if any, are the dangers of X-rays in the treatment of fibroid tumors of the uterus?" Practically all the answers indicated that the only danger to be feared was the production of an X-ray dermatitis. Every one, however, emphasized the fact that the work must be done only by skillful men. The danger to be expected in the hands of the unskilled operator was not

only burning, but the stimulation of the growth of the fibroid and the increasing of malignant degeneration if it happened to be present. I am reliably informed that there are in use in the United States 20,000 X-ray machines, and that there are comparatively few competent operators. We have never been able to control the surgical treatment of disease. Men are operating all over the breadth of this land without adequate surgical skill or equipment. There is no reason to believe that röntgenologists will be able to control the situation any better than the surgeons. Wait until it becomes generally known to every man with an X-ray machine in his office that fibroids have been cured by röntgenotherapy; then see the mortality jump. If tumors are to be treated by the rays, then the treatment should be undertaken only by men who are competent to do the work.

The view that burning is the only danger of the treatment is not universally accepted, however, by röntgenologists. The Archives of Röntgen Ray, June, 1913, speaks editorially as follows: "So far there has been little or no recurrence; but of course a considerable period must elapse before we are in a position to judge definitely of the value of the treatment and the *safety* of such enormous doses. When we consider the important tissues—intestines, peritoneum, blood-vessels, and glands—which must also be subjected to intense radiation, we realize how necessary it is to proceed with a good deal of caution." Henry Bedere drew attention to the possible injury to the intestines during irradiation of the pelvis and especially to the glands of Peyer's patches. Haenisch says it is doubtful if very anæmic women should be treated: bleeding may be increased—two fatal cases have been recorded.

Danger may also result from treating unsuitable cases. Bordier (4) gives the following contra-indications: When the fibroid is calcified, or presenting necrobiotic changes; those which are malignant, infected, or gangrenous; or in the presence if such complications as pyosalpinx or pelvic peritonitis.

In order to obtain the opinion of American röntgenologists as to these contra-indications, the following question was presented: "What would be the probable result of X-ray therapy on (*a*) malignant degeneration; (*b*) cystic degeneration; (*c*) necrosis; (*d*) infection; (of the tumor)?" There was no unanimity of opinion expressed, but it struck me as rather remarkable that 17 of the answers stated that the rays would benefit all of these complications. Practically all of the answers stated that the effect on malignancy would be retardation or possibly cure, though several emphasized the stimulation of the process if the treatment was improperly done. A few answers indicated that cystic degeneration would result in calcification, though the majority stated that the process would be increased. It was conceded by the majority that necrosis and infection would be made worse by the treatment and that these complications were a positive contra-indication to the treatment.

In connection with this phase of the subject the surgeons were asked, "In what percentage of your cases are you able to diagnose before operation, (*a*) malignant degeneration; (*b*) cystic degeneration; (*c*) necrosis; (*d*) infection?" The röntgenologists were asked, "Do you believe it advisable to have a gynecologist examine all cases of fibroids before beginning the X-ray therapy?" These two questions were asked for definite reasons. In the majority of papers on this subject presented by röntgenologists, the opinion has been expressed that a gynecologist should examine all cases before the beginning of treatment so that these various complications could be eliminated. My purpose in asking the surgeons the question I did was to show, what I have personally experienced, that it is only possible to make a full and correct diagnosis in the majority of cases at the time of operation, and hence that such an examination under ordinary circumstances is without much value. I was not disappointed in the replies I received from the surgeons. Practically all agreed that a correct diagnosis is usually impossible before operation.

With but few exceptions the röntgenologists answered yes to the question, the principal reason given being that unless a competent person examined the patient unsuitable cases would be accepted for treatment. A few,

from their answers, undoubtedly classed the gynecologists as "doubting Thomases," as they expressed the opinion that the need of the gynecologist was to testify that a tumor had been present before treatment.

It is interesting to note that the various complications which render X-ray treatment unsuitable are the very ones that are responsible, in a great measure, for the high mortality rate of hysterectomy. In plain words, surgery has to assume the responsibility in the very serious cases which the X-rays would make worse. I venture the assertion that the mortality from hysterectomy, in competent hands, in the uncomplicated fibroids of the uterus would compare very favorably with that of uncomplicated appendicitis. If the complicated cases were eliminated from surgical statistics, there would be little reason to advocate anything to supplant it.

The most important question in this whole subject is that relating to a consideration of the various phases of malignancy associated with fibroid tumors of the uterus. Probably the most important paper on the subject is that of Miller (5)[1]. It is practically impossible to estimate with any accuracy the frequency of malignancy as a complication of uterine myoma. Miller gives a table taken from the reports of many authors and arrives at the conclusion that sarcoma occurs in but approximately 2 per cent of cases. There is no mention made of the frequency of carcinoma, which McDonald estimates as 3.7 per cent. As previously stated, I asked the surgeons how often they had found malignant degeneration in fibroid tumors. The answers varied, but the average frequency was about 5 per cent. I am perfectly satisfied that if a thorough routine pathological examination was made of every fibroid removed, we would find the incidence of malignant disease much higher than reported and, consequently, the frequency of recurrence after operation much less. In a personal communication, Dr. Stephen E. Tracy, who has made such a study in his own cases, tells me that he has found associated malignant disease, positive by histologic study, in 10 per cent of the cases.

[1]The Relation between Sarcoma and Myoma of the Uterus and its Bearing on X-ray Therapy of Uterine Myoma.

Miller's conclusions are as follows:

1. Sarcoma may be said to occur in about 2 per cent of all myomatous uteri.

2. The primary mortality of operative myoma therapy is still about 4 to 5 per cent.

3. A lasting cure of sarcoma of the uterus by the operative treatment can be expected only in 25 per cent of the cases at the most.

4. Considering the advantages of the X-ray over the operative treatment in regard to assured freedom from fatality, mistakes in the diagnosis of sarcoma amounting to 0.8 per cent make little difference.

5. When the public learns that not every tumor of the uterus demands operation, but that there are also efficient conservative methods, we shall certainly be in a position to get hold of more malignant growths in the curable stage.

In view of the above facts, I believe there can be no further doubt that a routine operative treatment of myoma of the uterus, for fear of sarcomatous degeneration, need not be carried out. The ghost should be buried at once.

These conclusions are specious, but they are not justified. Admitting that sarcoma occurs in but 2 per cent of cases, and that the mortality of hysterectomy is 5 per cent, surgeons are not getting that mortality because they are operating on account of the fear of sarcoma alone. Sarcoma uncured is not the only thing that kills these patients. What about carcinoma, necrosis, infections, torsion of the pedicle, intestinal adhesions and obstruction, and all the other complications that may occur? The reason we have such a high surgical mortality is that we have to operate in grave emergencies in many cases in order to save life. It is not fair to compare the total surgical mortality with the incidence of any one complication and to say that because the complication occurs less frequently than the mortality, the treatment should be discarded. These conclusions, of course, do not say this in so many words, but the application of the principle means just this. Particular exception is taken to Conclusion 5. I take just the opposite view, for I believe that as soon as the public learns of such a teaching they will not submit to surgery, but

will delay operation until the growth has so far developed as to be inoperable. I read this conclusion to mean that the cases of malignant degeneration will come to the *röntgenologist* for treatment while the growth is still in the curable stage. If my understanding of the statement is correct, then it means in no uncertain language that surgery is to be eliminated in all cases of malignant disease of the uterus, forsooth, because the primary mortality of operation is higher than the primary treatment by the X-ray. If this is true of the uterus then it is true of malignant disease of every organ of the body. I have the greatest regard for the efficacy of radiation in the treatment of cancer, but I believe there are but few men who would have the temerity to discard surgery in the treatment of malignant disease. Surgery is not ideal in the treatment of cancer, but it is far and away superior to any other method of treatment in the early stages of the disease.

The question of the limitations of the two methods is worthy of discussion. Surgery is, practically, only limited by the general condition of the patient. Röntgenotherapy, on the other hand, is limited to a great extent by conditions in the tumor itself. The various complications offering contra-indication have already been mentioned. Another contra-indication to the use of the rays is the age of the patient. Most authorities are in accord that the best results are obtained from irradiation in women at or after the menopause. In woman under forty the X-ray treatment is, generally, not applicable for the reasons that recurrences are apt to occur, that it takes too long to abolish symptoms and is therefore too expensive, and that it means sterilization of the woman. On the other hand, this is the most favorable time for surgery. If all fibroids were operated on early, before the various heart changes had taken place, and before the various degenerations and complications in the tumor had manifested themselves, the mortality would be one per cent or less. Again, it is often possible in the young woman with an uncomplicated fibroid to save her ovaries and enough endometrium to preserve for her the menstrual function. It should be unnecessary to say anything in reference to the treatment of the small pedunculated submucous polypi and the small growths that can be cured by myomectomy with the preservation of the fecundity of the woman. Here it must be admitted that surgery is in a class by itself.

It may seem that I am unalterably opposed to the use of the X-ray in the treatment of fibroid tumors of the uterus. Such a conclusion is far from the fact. As I stated in the first part of my paper, I believe it has a most important place in our therapy. In order to establish this field the following question was asked both the surgeons and röntgenologists: "Under what circumstances do you advise the X-ray in preference to surgery?" Seventeen out of forty-four surgeons who replied answered that they never advised it under any circumstances. The general context of the other answers from surgeons was that it was to be advised when the woman, as a result of serious heart or kidney disease or grave anæmia, was a poor surgical risk. The replies from the röntgenologists expressed a variety of opinions. Several stated that they always advised it in preference to surgery; others that they never advised it in preference to surgery when surgery was possible and acceptable; still others, when no complications existed that would require surgery and contra-indicate the use of the X-ray. A few would advise it only after the age of forty, in uncomplicated cases. The consensus of opinion seemed to agree with that expressed by the surgeons that its greatest field of usefulness was in those cases where surgery would be particularly hazardous.

Apparently there is no question as to the value of the X-ray treatment in certain classes of fibroid tumors of the uterus. It has been definitely proved that röntgenotherapy has, with but few exceptions controlled bleeding from myomas and has also reduced the size of the tumors in a certain percentage of cases where it has been used.

Many women with fibroid tumors of the uterus are poor surgical risks on account of anæmia or associated heart, kidney, pulmonary, and other general pathological conditions. To operate on many of these cases is to take an unnecessary risk when we have a method

which, even if it does not cure, at least will relieve dangerous symptoms. We realize that in many cases so treated the dangers of future development are present in spite of treatment, but we take the chance of betterment on account of the grave danger to life from an operation. Again, we find many women, and we will find many more in the future, who refuse surgical intervention. These should be subjected to X-ray therapy for the reason that in competent hands the possibility of being benefited is much greater than if nothing were done for them. In the gravely anæmic cases the X-ray should be used to control the bleeding and enable the patient to get into proper condition for surgical intervention.

### CONCLUSIONS

1. Surgery is the best treatment in fibroid tumors of the uterus and cannot be supplanted by any other known form of treatment.

2. Röntgenotherapy has an important place in the treatment of these tumors.

3. Surgeons and röntgenologists should not enter into competition with each other, but should work hand in hand for the relief of womankind.

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## STRANGULATED EPIGASTRIC HERNIA

By ALEXIS V. MOSCHCOWITZ, M. D., New York City
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IN an article entitled "The Pathogenesis and Treatment of Herniæ of the Linea Alba," which appeared in SURGERY, GYNECOLOGY AND OBSTETRICS, April, 1914, I made the statement that "strangulation is exceptionally rare in epigastric herniæ, but that it can occur is amply proved by an interesting report by Hotchkiss."

Less than one month after the publication of this statement such a case came under my observation.

H. C., 49 years of age, Russian, a tailor by occupation, was admitted to my service in Mt. Sinai Hospital, May 5, 1914. For the past eighteen years the patient noted a swelling, which was located midway between the xyphoid cartilage and the umbilicus. The swelling was soft, the size of an orange, and at times disappeared, until only a small portion of it remained visible. Operation was suggested to the patient, but was declined. Five days prior to his admission to the hospital, the swelling suddenly became larger, very painful, and tender. The skin covering it became hot and red; nor could he reduce its size by the customary manipulations. At no time did he vomit, but his habitual constipation was aggravated. The temperature at the time of his admission was 102.5° F., with a corresponding increase in the pulse rate. Other symptoms were entirely absent; indeed, his general condition did not suggest any serious malady. Upon physical examination the abdomen was found to be moderately distended, but this disappeared after a high enema, which was followed by a copious evacuation. Midway between the xyphoid cartilage and the umbilicus — not in the median line, however, but overlying the right rectus — there was a very firm mass, about the size of a small grapefruit; this mass was apparently located within the abdominal wall. The overlying skin was reddened, almost erysipelatous in appearance, and apparently adherent. There was no mobility whatever upon the underlying structures.

The diagnosis was rather doubtful. There seemed only two possibilities: either a strangulated epigastric hernia or an intramural abscess of the abdominal wall. The history of a preëxisting mass favored a strangulated hernia, but the absence of all general symptoms apparently negated such a possibility. The phenomena of acute inflammation were so pronounced that the

diagnosis of an intramural abscess of the abdominal wall seemed most probable.

*Operation*, May 6th: Exposure through a five-inch incision; retraction of the skin and subcutaneous fat revealed at once a strangulated hernia that had escaped from the abdomen through a circular aperture in the linea alba, about one inch in diameter. After incising the peritoneal sac some bloody fluid escaped; the prolapsed contents were tense, smooth, and œdematous, so that at first sight it seemed as though the contents were either the colon or stomach. The mass covered the hernial opening like a mushroom, so that the division of the constriction was difficult. When this was done the mass was found to be made up of prolapsed and strangulated omentum. This was ligated in chain ligatures and removed. The mass removed was the size of an orange. After reduction of the stumps, there was seen another somewhat smaller mass of fatty tissue just above the sac, but closely adherent to it. Closer examination revealed a continuation of this mass with the fat situated between the two layers of the falciform ligament of the liver. The fat was inflamed and in consequence was extirpated. The redundant portion of the sac was cut away, and the wound closed by overlapping its two margins. A separate counter-incision was made for drainage. Patient made an uninterrupted recovery and was discharged cured.

Thus far there have been recorded the following ten undoubted cases of strangulated epigastric hernia:

1. Fabré (Thèse de Paris, 1911). The hernial contents were composed of omentum and almost the entire transverse colon.

2. Dujarier and Berger (Presse Medical, April, 1910). The hernial contents were small intestine.

3. Sebba (Deutsche Medizinische Wochenschrift, October 28, 1910). The hernial contents were small intestine.

4, 5, and 6. Ridgway (British Medical Journal, December 17, 1910) reports three cases. In one case the contents were the transverse colon; in another case the contents were small intestines; and in the third case the contents were transverse colon and omentum.

7. Gussenbauer (Virchow-Hirsch Jahresberichte d. Gesammten Medizin, 1876, ii). The contents were small intestines.

8. Hotchkiss (Annals of Surgery, xliv, 78). The contents were omentum and small intestine.

9. V. Klein (Graefe and Walther, Journal der Chirurgie und Augenheilkunde, Berlin, 1820, p. 445). The contents were transverse colon.

10. Dieffenbach (Operative Chirurgie, Leipzig, 1848, ii, 616). This case very probably was a strangulated hernia; the contents were omentum and small intestine.

Some of the articles published refer to a publication by Wiesinger[1] and credit him with two or three cases. Careful study of his article, however, has failed to convince me that any of the cases he reports were true strangulated epigastric herniæ. Nowhere in this article, except in the title, is mention made of a hernia of the linea alba, as I understand such a hernia to be. I am not even convinced that they were herniæ; but granting even that they were, it is more than probable that they were of the umbilical variety. Additional corroboration of this surmise is found in the ages of Wiesinger's patients, namely 1¼, 8, and 5 years respectively. In fact, if my understanding is correct, Wiesinger's main purpose was to call attention to the point that it is possible to have in these herniæ a strangulation of only a part of the wall of the intestine; i. e., a so-called Richter's hernia. After careful consideration it seems wisest on the whole to place Wiesinger's three cases in a doubtful class.

Uhde[2] publishes a case which may have been a strangulated epigastric hernia. In addition, he also collected all the cases, thirteen in number, which have appeared up to the date of his publication, some dating as far back as 1797. Of all these cases, however, only the two cases reported by V. Klein and by Dieffenbach may be regarded as valid. Critique of the original articles leads me to the belief that the remaining cases were of the umbilical variety.

The rarity of strangulated epigastric hernia becomes obvious when the pathological anatomy of epigastric hernia is taken into consideration. In the paper already referred to, I laid down the principle that the majority of epigastric herniæ are not herniæ in the true sense of the word, but merely prolapses

[1] Deutsche Ztschr. f. Chir., lxvii, 83.

[2] Arch. f. klin. Chir., xi, 285.

of the fat enclosed within the two layers of the falciform ligament of the liver. Only a very small number of so-called epigastric hernia are herniæ in the true sense of the word, so that strangulation must, of necessity, be proportionately rare.

The case which I report is also of interest from a pathological and symptomatic viewpoint. The hernial protrusion was made up of two distinct portions. One, the upper and smaller one, was distinctly extraperitoneal and composed of the fat situated between the two layers of the falciform ligament of the liver. This confirms the contention already stated, in regard to the pathogenesis of these herniæ. The second, the lower and larger one, was composed of omentum, which had become strangulated within the hernial sac. The explanation of the succession of events in this case is the following: At first there was merely a protrusion of the fat enclosed between the two layers of the falciform ligament of the liver. In the growth of the "hernia," only the left leaf of the peritoneal surface of the falciform ligament was pulled out in the form of a sac, in which omentum became lodged. Strangulation was the final event.

The symptomatology and prognosis of strangulated epigastric hernia does not differ from that of any other hernia similarly strangulated. In our case the symptoms were so trifling and evanescent as to lead in part to a faulty diagnosis. Only the consideration of the possibility of its being a strangulated epigastric hernia led to a careful execution of the operation and the successful outcome.

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## UNTOWARD RESULTS OF PYELOGRAPHY

By MARTIN KROTOSZYNER, M. D., San Francisco

WITH the advent of the newer methods of examination the diagnosis of pathological conditions of the genito-urinary tract at once assumed an aspect of precision and scientific exactness. The clinical picture, the examination of urine, cystoscopy, ureteral catheterization, the determination of renal function, and radiography are the methods at our disposal to-day which, if carefully and intelligently applied, suffice in the great majority of instances for the diagnosis of an existing lesion.

It is nevertheless true that not all problems of renal pathology can be solved by these means. Especially those lesions that are not characterized by an appreciable deterioration of renal function may require for their correct recognition a demonstration of their anatomical abnormalities, on the basis of which exact conclusions as regards contemplated measures of treatment might be formulated. Such a definitely anatomical diagnostic method is furnished by pyelography, the technique of which has been rapidly perfected, so that the pictures provided by this means may render the diagnosis as exact and convincing as an anatomical specimen; in fact, every experienced renal surgeon has encountered cases in which the *prima facie* evidence produced by pyelography represents the most important factor in the construction of a difficult diagnosis.

It is therefore not surprising that pyelography rapidly became a method of routine examination at the hands of many renal surgeons. Characteristic of its extensive use at large and progressive surgical centers is Braasch's (1) report from the Mayo clinic, based upon more than 500 pyelographic exposures during a period of three years. Briefly stated, Braasch's conclusions are that pyelography, if correctly applied, is not connected with any permanent injury, that the objections to the method, as being dangerous and painful, are trivial; and that it should be used without hesitancy in lesions of the genito-urinary tract with doubtful or perplexing diagnostic features. The harmlessness of pyelography was again accentuated by von Lichtenberg and Dietlen at the sixth Röntgen

Congress in 1910. Equally favorable, though somewhat more guarded as regards its scope of application, is the opinion of Voelcker (2) who considers pyelography, if carefully done and particularly if applied in cases of chronically enlarged renal pelves, an almost painless procedure that is never followed by permanent lesions.

It is not my purpose at this time to dilate upon the technique and the diagnostic possibilities of pyelography. I merely wish to discuss the untoward results and dangers of the method which may occur in spite of the utmost care in its application, and in this connection I beg to report the following observation:

A man of 36 had suffered, for several years past, from digestive disturbances and intermittent attacks of right-sided abdominal colic associated with vomiting. He entered the hospital, while suffering from one of these attacks, where a urinalysis demonstrated a considerable amount of microscopic pus and blood. He was therefore transferred to my urological service.

Physical examination negative; kidneys not palpable; hydrocele of moderate size on left side; cystoscopy negative. The ureter catheter is impeded on the right side at a point about 6 cm. from the renal pelvis. After bilateral catheterization urine flows apparently under pressure and in a continuous stream from the right side; the spurt becomes intermittent after evacuation of about 25 ccm. Microscopically, the right-sided secretion shows a number of pus-cells, some of them in clumps, fresh blood-corpuscles and blood-shades, and desquamated epithelial cells. Various and repeatedly performed functional tests demonstrate a uniformly marked deterioration of renal function of the right side (sugar after phloridzin appears in 65 minutes on the right, and in 17 minutes on the left side, its quantity is 0.1 and 2.5 respectively; only a trace of phthalein is recovered from the right side, etc.).

The secretion of the left kidney proves to be microscopically and functionally normal; direct radiography negative.

I am indebted to Dr. Wm. Ophüls of the Leland Stanford Jr. University for the report upon the bacteriological examination of urine from the right kidney:

Fig. 1.

Smears show many polymorphonuclear leucocytes and lymphocytes, some large phagocytes, a few gram-negative bacilli, a few small gram-positive diplococci, several groups of extremely small gram-negative bacteria (smaller than influenza bacilli). On cultures no visible growth; a smear shows many extremely small bacteria. No tubercle bacilli found in spite of careful search.

Pyelography was now made by injecting about 15 ccm. of a twenty-five per cent freshly prepared and slightly warmed aqueous cargentos solution into the right pelvis. As usual, the injection was made through a small-caliberd (No. 5) bismuth-catheter and by means of a large all-glass syringe of 20 ccm. capacity, the needle of which filled the end of the catheter. The piston of the syringe was used under gentle pressure to start the flow and the fluid was allowed to enter the renal pelvis by hydrostatic pressure by lifting the syringe as much as possible above the level of the patient's body. In this manner the injection was continued during the process of taking the picture, while black-colored silver solution was seen to dribble from the

Fig. 2. Hæmorrhagic areas at *a*.

evacuating shaft of the cystoscope which had remained *in situ*. At no time during and after the pyelographic procedure were any marked untoward subjective (pain) or objective (fever) symptoms noticeable. The pyelographic plate (Fig. 1) showed a narrowing of the right ureter beginning at a point about five cm. below the renal pelvis and extending about three cm. downward, and a moderate dilatation of the canal above and below this area; the ureteropelvic juncture appeared to be angulated and the renal pelvis and upper calices dilated. No dystopia of the kidney could be ascertained from the plate which, obviously, demonstrated the existence of a moderate hydronephrosis, probably due to ureteral stricture.

At the operation, three days after pyelography, the exposed right kidney showed on its surface a number of dark-colored areas of various size which projected slightly over the surrounding tissue. At the upper pole of the organ the tissue was, upon palpation, softened and flabby; the ureter entered the enlarged pelvis under an angle. The incised organ showed on its cut surface well-defined, grayish white nodular areas resembling caseous spots and some dark brown necrotic foci like those on the surface; a particularly large necrotic focus was visible at the upper pole. The calices were moderately dilated.

On the basis of these findings and the previously ascertained satisfactory condition of the left kidney, the right organ was removed. The patient made an uneventful recovery.

Dr. Ophüls' pathological report is as follows:

Kidney of nearly normal size; surface slightly granular, especially along convexity. There are also several star-shaped scars of moderate size.

On the surface of the organ one sees very many minute hæmorrhages and a considerable number of fairly well defined hæmorrhagic areas which project slightly over the adjoining tissue (Fig. 2, at *a*). The largest one of these spots measures about two cm. in diameter. In addition to the dark-red discoloration due to hæmorrhage, these areas show a distinct brownish hue due to the silver.

On the cut surface some of the areas are nodular in character and grayish white in color, resembling caseous spots. The larger projecting spots are distinctly cone-shaped with a lighter necrotic center and dark hæmorrhagic periphery. On the cut surface, also, the brown discoloration of the tissues is very evident. Some of the areas extend through the cortex and the medulla to the renal pelvis.

Microscopically, the silver is found largely in the tubules. In some places in the cortex the tubules are ruptured and the silver is discharged into the tissues. About the masses of pigment there are large necrotic foci showing beginning proliferation at the edges, where there are also extensive hæmorrhages. The tissues are infiltrated with lymphocytes and in places there are large collections of polymorphonuclear leucocytes. In some parts the necrotic material is liquefied and aseptic abscess-cavities have formed which are filled with polymorphonuclear leucocytes. No bacteria were found in the lesions in spite of careful search in numerous smears and in different places. No tubercle bacilli were discovered, and a guinea pig which was inoculated with material from the lesions intraperitoneally did not show any lesions one month later.

The kidney shows also a moderate arteriosclerosis of the branches of the renal artery and many small arteriosclerotic scars (Figs. 3, 4, and 5).

Renal lesions of like or similar character and extension after pyelography are reported from abroad by Ekehorn, Jerwell, Oehlecker, Troell, Zachrissen, and Blum. They were collected and comprehensively reviewed by Schwarzwald (3) who adds one case of his own. In this country, Tennant (4) and Mason (5) have described cases in which the kidney was

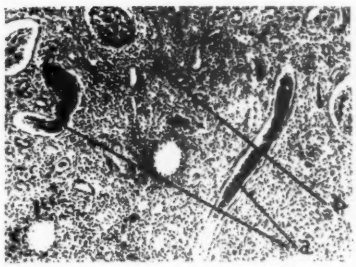


Fig. 3.

Fig. 3. Masses of silver in tubules. *a*, Marked cellular infiltration of adjoining parts of renal tissue. The cells are partly polymorphonuclear lymphocytes, of which some are found in the tubules containing the silver. There are also many lymphocytes in certain parts of the field. *b*, The connective-tissue cells show marked evidence of proliferation leading to atrophy of many tubules in the affected area. B. & L. Obj. 2/3 Oc. I.

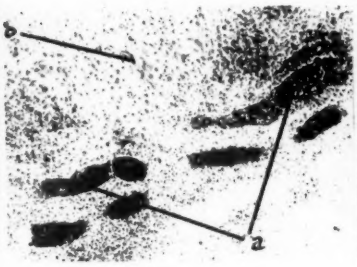


Fig. 4.

Fig. 4. Several straight tubules full of silver. *a*, Surrounding tissue necrotic, full of hæmorrhages, infiltrated with polymorphonuclear leucocytes. *b*, Lymphocytic infiltration and recent proliferation of connective tissue. B. & L. Obj. 2/3 Oc. I.

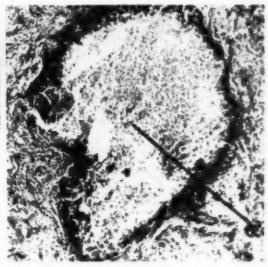

Fig. 5.

Fig. 5. Area of destruction in renal tissue with liquefaction of necrotic tissue and formation of aseptic abscess. *a*, Cellular proliferation of the connective tissue about the abscess cavity. B. & L. Obj. 2/3 Oc. I.

damaged by collargol injections, and the presumption is justified that not all cases of injurious effects of silver-salt injections for pyelographic purposes have been brought to the notice of the profession through publication.

A fatal accident in connection with pyelography was first reported by Roessle (6). In his opinion, death in this instance was due to acute argyria through collargol poisoning, since certain symptoms, observed in that patient prior to death, tallied with the clinical picture of acute silver toxæmia. I have made a similar observation in a weak and cachectic woman of about 40, in whom, shortly after the injection of a small amount of silver solution into the renal pelvis, vomiting, cyanosis, diarrhœa, and slight hæmaturia, connected with attacks of almost uncontrollable excitability, ensued. No autopsy could be obtained in this case, but I have no doubt of the etiological connection of this symptom-complex with the silver injection.

Rosenblatt and Margoulies (7) report the case of a man of 45, with sudden collapse during the injection of 40 ccm. of five-per-cent collargol. Death occurred fifteen hours after pyelography and was due to perforation of the renal pelvis.

I have, at a recent meeting of the American Medical Association (10), in discussing the subject of early hydronephrosis, mentioned the case of an old cachectic individual of 73, in whom one week after pyelography, by means of injecting a few cubic centimeters of a twenty-per-cent cargentos solution, at the autopsy severe parenchymatous lesions of the injected kidney were ascertained. Besides these graver lesions I have like others repeatedly observed, after pyelography, pain on the injected side, rise of temperature lasting several days, and occasionally nausea and vomiting. On account of the frequency of these symptoms soon after pyelography, Voelcker and von Lichtenberg advised the preliminary administration of morphine hypodermatically — an inadvisable step, because eliminating pain, which is the most important danger signal of too high pressure during injection.

Distressing symptoms after pyelography are in all probability due to the fact that the silver solution quite frequently penetrates into the urinary tubules and thus causes parenchymatous lesions of either light and temporary, or of more serious and permanent, character. If these lesions, as in most instances, are insignificant, the integrity of the kidney, after the disappearance of all subjective symptoms, becomes readily reëstablished. No trace of the silver-salt, injected a few days previous to nephrectomy, could be ascertained in a number of kidneys of my cases, and a careful microscopic examination of sections did not demonstrate any evidence of damage done

by pyelography. Pathological findings, on the other hand, as in the case described above, force upon us the conclusion that pyelography is a rather risky method, the application of which should only take place on the basis of strict indications and extreme caution.

The question therefore arises, Are the dangers and distressing sequels of pyelography offset by its diagnostic advantages?

In the case reported above, no unusual diagnostic difficulties were present that could not have been overcome without pyelography. The history, the clinical and cystoscopic findings, including the character of the urinary spurt, the definite functional deficiency and microscopic aspect of the right-sided renal secretion, made the diagnosis "infected hydronephrosis" highly probable, and, on the basis of negative plate and bacteriological evidence (nephrolithiasis, tuberculosis), sufficiently exact to warrant the operative exposure of the affected kidney. The pre-operative formulation, though, of the character of the operation, whether plastic (pyeloplication, nephropexy) or radical (nephrectomy), became feasible only through pyelography, which at once gave the correct conception of the size and shape of the renal pelvis and calices and, what is more important, of the relations of the existing ureteral abnormalities to the kidney.

Everybody possessing personal experience with the plastic pictures produced by pyelography will agree that in no other way can the topographical relations of the kidney, its pelvis and ureter, to other organs of the abdominal cavity be ascertained; this method, moreover, has proved to be of such inestimable value, especially in the correct recognition of beginning mechanical renal lesions, resulting in dilatation without functional disturbance, that we cannot afford to miss it in our urological diagnostic armamentarium.

It would therefore be extremely regrettable if pyelography should become discredited or, by being stigmatized as harmful and dangerous, fall into disuse. It has undoubtedly in our first enthusiasm been applied indiscriminately and unnecessarily, without due regard to the technique prescribed by its originators, and on individuals with inadequate resistance. A careful and critical perusal of the rapidly increasing literature upon the dangerous and distressing sequels of pyelography does not permit of binding conclusions as regards their real cause, which apparently is not represented by the quantity, concentration, or choice of the shadow-casting preparation (collargol, cargentos, argyrol, etc.). Undue pressure in injecting is in all probability responsible for many bad and distressing results. Fatal accidents, on the other hand, have occurred in spite of apparently faultless technique and, in two instances, after the injection of a silver solution of low concentration (four and five per cent collargol) Moreover, the very large number of pyelographies without any subsequent injury permits of the conclusion that an unknown and accidental and possibly avoidable agent must play an important rôle in the occurrence of untoward results. Many mooted questions in connection with pyelography will undoubtedly be settled sooner or later on the basis of experimental work as started abroad by Strassmann (11), Blum (12), and Schachnoff (13), and as lately taken up by Eisendrath (14) in this country. Meanwhile, it behooves us to draw strict indications to the application of pyelography, to limit it to those cases in which the existence of a dilated renal pelvis appears to be highly probable through other means of examination, and to perform it with the greatest possible caution.

## CONCLUSIONS

Though pyelography is justly considered as of definite diagnostic value in some renal lesions (dilatation of renal pelvis and calices without functional disturbance, malposition of kidney, etc.), a correct diagnosis of the great majority of surgical kidney conditions is, nevertheless, feasible without this method. The general acceptance of strict contra-indications to pyelography is the more indicated, since it is proved that solutions, though brought into the kidney pelvis with faultless technique and without undue pressure, may penetrate into the tubules and the surrounding kidney-tissue and cause serious inflammatory lesions resulting in necrotic foci.

Pyelography should, therefore, be restricted to those comparatively rare cases in which

the correct recognition of a renal lesion by a combination of all other exact methods of examination is impossible.

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# DEPARTMENT OF TECHNIQUE

## TREATMENT BY CAUTERY OF GASTRIC ULCER

By DONALD C. BALFOUR, M. B., Toronto
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WHATEVER differences of opinion may exist as to the treatment of gastric ulcer, it is at least accepted as logical that the ideal procedure in our present conception of "surgical treatment" should be the removal of the ulcer. In a given case of gastric ulcer in any situation, except perhaps at the pylorus, the first problems to be settled are whether the ulcer can be excised with safety, what method shall be employed, and whether the excision should be followed by a gastro-enterostomy.

It is not my purpose to discuss at this time the merits of the various principles advanced in the treatment of gastric ulcer, but rather to draw attention to a method which I believe will find a place in the treatment of at least a certain percentage of these cases. In describing this procedure, however, it may be advisable to refer to

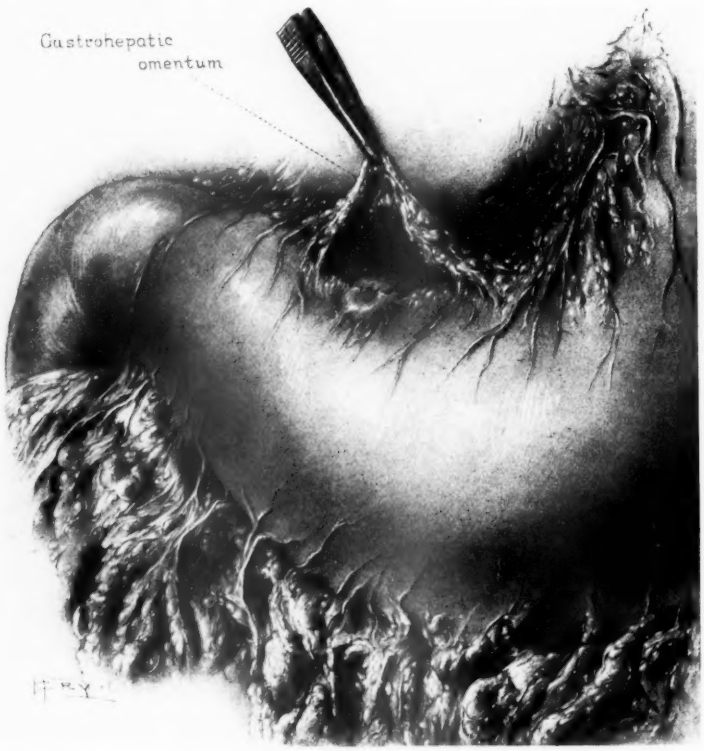


Fig. 1. Ulcer on anterior wall with gastrohepatic omentum dissected from lesser curvature.

some of the more serious problems to be met with in the excision of a gastric ulcer.

It may be safely stated that as a general rule the chief difficulty is not the removal of the ulcer except when located high on the lesser curvature, but rather the satisfactory closure of the opening thus made. The treatment of gastric ulcer by excision and suture, with or without gastro-enterostomy, may be a formidable operation even in the hands of experienced surgeons, and one which entails considerable risk to the patient.

The most immediate post-operative dangers are those of hæmorrhage and impaired gastric motility incident to interference with the nerve supply in extensive excisions along the lesser curvature. Later complications are usually due to the deformity resulting from contracture at the point of closure.

Hæmorrhage occurring late, that is, after the seventh or eighth day, is occasionally of serious consequence. The condition is somewhat deceptive in that the bleeding is not profuse, but persistent, and may result fatally, as has recently occurred in our clinic, in which case a secondary gastro-enterostomy and transfusion of blood failed to prevent a fatal issue. The autopsy in this case showed that the mucous membrane had separated and left a large denuded area from which the bleeding had taken place. Such a complication at such a time is probably dependent upon the fact that after the excision of the ulcer there is a marked tendency of the mucosa to retract, and the tension required to approximate it may predispose the sutures to give way during the second week.

In observing the seriousness of these complications, particularly of late hæmorrhage, it occurred to the writer that some method might be devised whereby the ulcer could be destroyed in such a manner as to obviate any possibility of hæmorrhage, either early or late, without removing an appreciable amount of healthy gastric wall. That this could be accomplished by the actual cautery seemed obvious. The cautery is one of the most satisfactory methods of dealing with many superficial ulcerations, early epithelioma, certain forms of carcinoma (cervical, buccal,

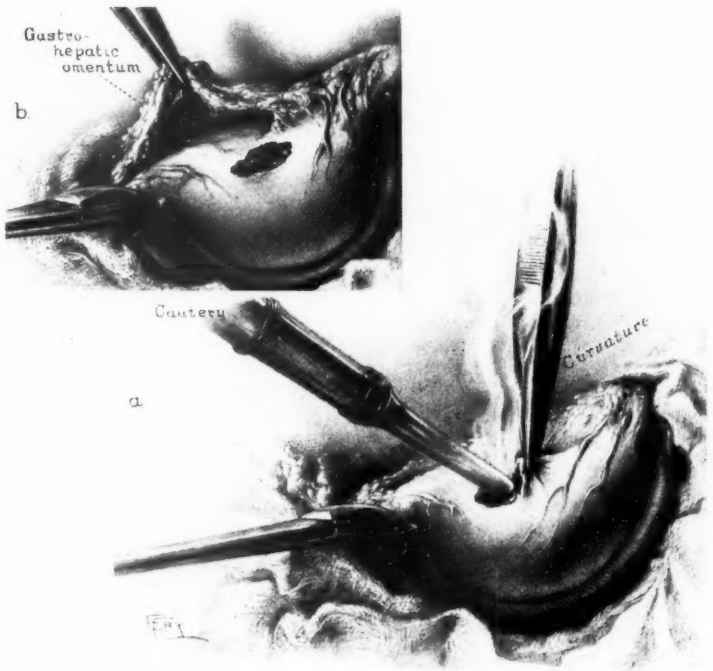


Fig. 2. (a) Burning out ulcer. (b) Ulcer burned completely through.

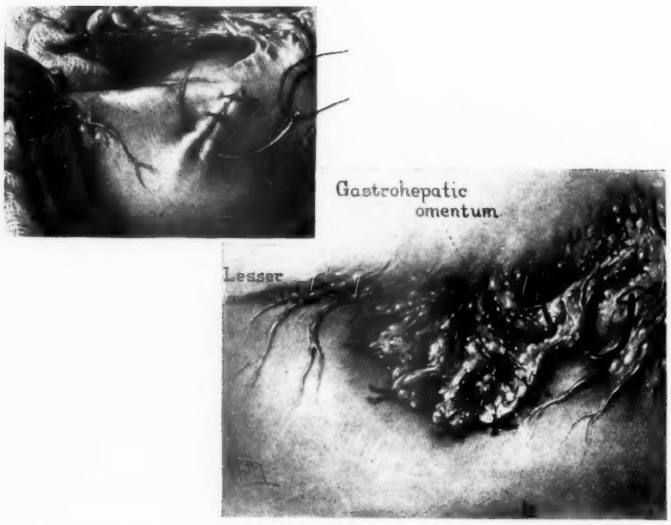


Fig. 3. (a) First row of sutures closing opening from which ulcer has been excised. (b) Ulcer area covered by gastrohepatic omentum.

etc.), by virtue not only of its destruction of tissue but also its inhibition of hæmorrhage. The application of the principle described herewith was, therefore, suggested and while it has been used in the Mayo Clinic in a sufficient number of cases to warrant reporting, we are not as yet in position to state how the size, character, and situation of the ulcer will affect the limitations of the method. The following technique has been employed in the cases thus far operated on by this method:

The portion of the gastrohepatic omentum in the region of the ulcer is carefully dissected free from the lesser curvature (Fig. 1). The ulcer is carefully palpated and with a Pacquelin cautery maintained at a dull heat the point is slowly carried through the ulcer until an artificial perforation is produced. The moderate burning is continued until the actual area of the ulcer is entirely destroyed (Fig. 2a). The resultant perforation is shown in (Fig. 2b). Closure of the opening is then made by interrupted sutures of chromicized catgut reënforced by mattress sutures of silk (Fig. 3a). The reflected gastrohepatic omentum is then replaced over the site of the ulcer and fixed by superficial interrupted sutures of fine silk (Fig. 3b).

In the application of this method the following facts are apparent:

1. The ulcer is destroyed and with it any early malignancy which may exist.
2. There is little sacrifice of sound gastric tissue, and secondary contraction is therefore minimized.
3. Hæmorrhage, early or late, is with practical certainty prevented.
4. Its simplicity, speed of accomplishment, and safety.

# AUTOPLASTIC BONE GRAFTING[1]

## With Exhibition of Lantern Slides

By JOHN F. OECHSNER, M. D., New Orleans
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MUCH healthy controversy exists to-day and an active experimental research as to the respective function of periosteum and bone in the now thoroughly established surgical procedure of bone transplantation.

On the one hand we have Axhausen and his followers, and Ollier, who preceded him, who hold that bone possesses its power of regeneration by virtue of its periosteum. On the other, Macewen and his disciples contend that the bony graft itself regenerates the new bone by virtue of the osteoblasts within the graft itself. Again, Murphy holds that the graft is not osteogenetic, but osteoconductive.

Among research workers we have but to mention the two recent articles of McWilliams on the one side and Cohn on the other. The former contends, from his well conducted experiments, that our reliance must be placed on the periosteum; and the latter that our salvation depends on the bone itself, regardless of its periosteum.

From time immemorial we have been taught, and I think with justice and propriety, that the periosteum is the osteogenetic tissue of bone. To Ollier, who worked in the pre-aseptic period, probably belongs the credit of having established the feasibility of filling in bone gaps by means of transplants. Scrutinizing the methods of Schede with his aseptic blood-clot and Neuber with his skin invagination, we find that these men depended, probably unconsciously, upon the osteoconductivity of the anatomic structures which they utilized. Senn, in the use of his decalcified bone chips, utilized both the osteoconductive power of his chips together with the osteogenetic power of osteoblasts which were very probably introduced.

All of these observers have met with an element of greater or lesser success in their experiments and observations, so that the impartial worker is left in more or less of a quandary as to who is right and whom he should follow in his own work. If we study diligently and calmly all of this work, together with our own personal experiences, I think we should have no difficulty in arriving at a safe and satisfactory conclusion.

In the experimental work with bone and periosteum exclusively, the material used has been necessarily small, which I think a very important factor in its reliability regarding deductions for its application to the practical work of filling in large bone gaps. The same holds in the case of bones, denuded of periosteum, used by Macewen, who broke his bone into small chips, and who tells us that most of them were periosteum free, inferring that some at least were covered with periosteum and others contained endosteum.

Macewen attributes to the periosteum only the power of limiting bone growth. He says, and very properly, and here he strikes the nail on the head, that transplanted periosteum regenerates bone only by virtue of the osteoblasts which were carried with it; in the same breath he does the periosteum the injustice of saying it is only a limiting membrane. It surely seems that we are splitting hairs. In none of the experiments, whether of periosteum exclusively, or bone exclusively, have we gotten entirely rid of that most important physiological factor, the osteoblast.

In studying the elaborate work of Nicholls on the subject of osteomyelitis we are impressed with his results. He has excised complete shafts of necrosed long bones and sutured the periosteum in such a way as to create a periosteal column in which and along which the bone has regenerated to an extent as complete as the original. We have followed Nicholls in some of our own cases with similar results. We have taught persistently, and I believe consistently, that when periosteum retains its vitality it will regenerate new bone, and in our clinical work have shown where the periosteum has sloughed there would be no regeneration.

This is well shown in the first radiograph of our second case. This picture was taken some months after the original operation for excision of an osteomyelitic tibia. At operation it was found that at the junction of the lower and middle thirds of the leg the periosteum was gone, and it was predicted at the time there would be no bone regeneration at that point. The subsequent course of the case verified the prediction. It might be argued that growth occurred from the ends of the bone, and this is true, but at the point of periosteal slough there was absolutely no regeneration.

If we study the histology of bone, as Nicholls

[1] Read before the Louisiana State Medical Society at New Orleans, La., April 24, 1914.

Case No. 1, Plate 1. October 13, 1911. Anteroposterior view of leg before transplanting operation.

Case No. 1, Plate 4. November 16, 1911. Nineteen days after operation, transplanted bone in good condition.

Case No. 1, Plate 7. June 6, 1912. Eight months after operation.

has so well done, we find that the periosteum is rich in blood-vessels and keeps up the nutrition of the underlying bone; the cortical layer on the other hand, from its very compact nature, is incapable of rapid blood-vessel regeneration, if left, therefore, in a large bone gap without its physiological prop, the periosteum, it would die or prove itself a foreign body before blood-vessels would re-form. It does act, however, as Murphy says, as a scaffold for the further development of blood-vessels which already exist in its attached periosteum. It is most interesting to note that in not one of Murphy's cases did he fail to transplant periosteum with his graft.

While we welcome and encourage the healthy controversy and experiments of our confreres, for all practical purposes, especially in filling in long gaps, it matters not whether it be bone, or periosteum, or osteoblasts, which does the work. Successes depend upon mechanics and physiology, osteoconductivity, and osteogenesis. More rapid and better results will be secured if we give weighty consideration to all of these individual factors. Bone alone is mechanically efficient but physiologically deficient; periosteum alone, or with its attached osteoblasts, physiologically efficient, and mechanically deficient.

Summing up, therefore, our deductions are, that long bone transplants are dependent for their success upon (a) the mechanical support of the bone itself and (b) the physiologic element of regeneration, as conveyed by its periosteum, endosteum, and osteoblasts.

The following two cases illustrate the practicability of the operation of bone transplantation and the apparent perfect result.

CASE 1. Dora Bell was first admitted to our service October 5, 1909, suffering with a chronic osteomyelitis. On October 9, 1909, the entire shaft of tibia from the upper to the lower epiphyseal junctions was excised, the entire bone having been destroyed and being found riddled with sinuses. She was discharged February 9, 1910, cured. She was readmitted on November 17, 1910, suffering with a very much deformed leg due to the growth of the fibula and a failure of regeneration of bone at the site of the removed tibia. The limb was in a state of pathologic bowleg and the foot in a position of talipes varus. During her stay in the hospital the fibula was broken and the leg straightened. In order to enable her to walk, a brace was ordered for her. She was admitted a third time on October 11, 1911, on which occasion the work under discussion was done. X-ray plate 1, taken October 13, 1911, shows a clear outline of the broken fibula and what has been left of the tibia. It will be seen that there was a slight regeneration of bone at the upper end where the periosteum remained intact, but none throughout the remainder of the bone where the periosteum had sloughed previous to the first operation, as a result of the primary suppurative infection.

*Operation* October 28, 1911. Autogenous bone transplantation; ether anæsthesia. The fibula of the affected leg was again broken to correct the recurring deformity and put the leg in the best possible position to receive the graft. An incision about eight inches long was made over the site of the previous operation, all of the scar tissue removed and adhesions liberated, the upper and lower ends of tibia were thoroughly freed, and between them the muscular bed made snug and clean. To properly receive the graft the upper and lower ends of the tibia were shelved. Next an incision was made over the tibia of the sound leg, a transverse incision at the upper and lower ends was made with a saw, the periosteum for about three-eighths of an inch incised to meet these transverse saw cuts, and a piece of bone with its periosteum included in these four incisions was very gently chiseled off. The graft measured about five inches in length, three-eighths of an inch in width, and probably one-eighth of an inch in thickness, involving in its thickness the whole of the compact layer of bone together at its upper end with a little of the medulla. Owing to the thinness of the graft it curled. This was straightened out, the graft placed in the bed prepared for its reception, and the ends tacked to the tibial stumps by means of French nails cut the proper length. Continuous catgut sutures closed the muscular tissues over the new bone. Interrupted silkworm gut and continuous silk sutures were used to close the skin. Small iodoform wick drains were used in the upper and lower ends of the wound. The usual dressings were applied and a posterior guttered splint. Seventy-two hours after operation the leg was dressed and the wound contained some blood and serum. The iodoform gauze drain was replaced by some strands of silkworm gut. Four days later the wound was again dressed, and on the eleventh day after operation all the sutures were removed, the limb looked well, and there was no pus or blood present. On the eighteenth of November, twenty-one days after operation, two days after the next X-ray picture was taken the wound was found entirely healed and a plaster of Paris cast was applied, running from above the knee and including the foot.

X-ray picture No. 2, taken nineteen days after operation, shows the transplanted bone in good position. A picture of the sound leg taken on the same day shows clearly where the bone-graft is removed. Regarding the treatment of the sound leg, we failed to mention that the periosteum was sutured with continuous catgut and the external wound with silk. The wound healed promptly.

Case 2, Plate 1.

Case 2, Plate 2.

Case 2, Plate 1. August 19, 1912. Showing amount of regeneration of bone in two months after primary operation.

Case 2, Plate 2. December 19, 1912, six months after primary operation.

A third picture taken on January 4, 1912, sixty-eight days after operation, shows distinctly the regeneration of bone and the graft in good position. An examination of the leg shows that the bone has regenerated decidedly; in fact, at the junction of the middle and lower thirds it seems to be as large as a normal tibia. Throughout the extent of the leg it can be felt as well as seen by the X-ray picture that the bone is regenerating beautifully. Of course the fact of permeability of new bone to X-ray the same as that of callous must be taken into consideration in reading a picture; nevertheless, this picture shows clearly the new bone. It will be interesting to note during the next year or two just what developments in length, as well as in thickness, of the leg occurs. Inasmuch as the growth of bone occurs from the epiphysis we feel that if these have been intact the bone should grow.

The following comparative measurements in this connection are of interest:

| | Before operation. | Four months after operation. |
|---|---|---|
| Anteriar superior spine of ilium to innei malleolus | Rt. 21 in. | 21¼ in. |
| | Lt. 19 in. | 20 in. |
| Circumference of leg middle third | Rt. 8½ in. | 9 in. |
| | Lt. 7 in. | 8½ in. |

CASE 2. Angie Holton, nine years of age, was first operated for her necrosed tibia June 12, 1912. The operation showed extensive involvement of the tibia, necessitating its excision from the junction of the upper and

Case 2, Plate 3, April 22, 1913.

Case 2, Plate 4.

Case 2, Plate 5.

middle thirds to just above the malleolus. The periosteum was sutured according to the method of Nicholls. The skiagraph of the infected tibia before operation has unfortunately been lost.

The first skiagraph shows the regeneration of bone before the transplanting operation. On March 1, 1913, the operation of transplanting was done. The scar tissue was removed from the affected limb, a muscular bed prepared for the reception of the graft, and the upper and lower ends of the remaining bone were shelved for the reception of the graft, as in the first case. The opposing surfaces were too thin for the use of a wire nail, and instead wire loops were used, as shown in the skiagraph. The sound limb was prepared for the removal of the graft, which was taken, as in the previous case, from the anterior surface of the tibia. This graft was about six inches long by one-half inch wide by about one-eighth inch thick, and included a full periosteal covering, and its upper extremity part of the medullary substance of the bone.

We had the misfortune of having the graft partially break at the junction of its lower and middle thirds, and the resultant traumatism permitted subsequent infection. This suppuration continued, and on May 3d, practically two months after the grafting operation, the leg was opened, several pieces of dead bone were removed, as well as the two lower wires. The leg was subsequently treated as all infected wounds are, and in time healed completely. Profuse secondary hæmorrhages occurred after the primary transplanting operation from traumatism to some of the larger vessels during operation. In spite of this depletion, and in spite of the suppuration and the development of small dead spiculæ, the radiographs will show that regeneration went on almost uninterruptedly.

Later in the year she came in for further observation, and the application of a light brace, as we wished to permit a certain amount of well guarded exercise. At this time she fell and broke the bone in its upper third. This fracture shows very well in one of the skiagraphs. A plaster case was applied which has remained on until the present time. Firm union of the fracture has taken place, and clinical observation of the limb, together with the study of the skiagraphs, seems to promise, in due course of

time, a perfectly sound leg. The patient is presented to-day for your inspection. The emaciation of the affected limb is due to its retention in a plaster cast. Of striking interest to us is the growth of the affected leg.

Following are the measurements taken February 27, 1913, two days before the transplanting operation; and the measurements taken April 21, 1914, one year, one month, and twenty-one days after the operation:

| | Before operation. | After operation. |
|---|---|---|
| From anterior superior iliac spine to inner malleolus | Rt. 25 in. | Rt. 27½ in. |
| | Lt. 26½ in. | Lt. 28 in. |

The affected limb has grown in something over a year two and a half inches, and the sound limb was longer by one and a half inches at time of operation, and now it is but one-half inch longer.

A further study of the skiagraphs demonstrates in Case 1 that there has been a most rapid development of bone, so that apparently the new bone was larger than the old. It appears highly improbable that this could have occurred alone through the medium of blood-vessel development on the one hand, or simple osteoblastic deposits on the other, but rather to a combination of both.

In the second series we find that in spite of the destruction of a certain amount of bone, regeneration seems to have gone on uninterruptedly. And in these skiagraphs it will be clearly observed that the cortical layer of the bone seems to be developing very rapidly. In other words, in both series it seems highly improbable that any one factor singly was responsible for the bone regeneration, but rather should we think that both factors have been at work.

A third patient demonstrates the fact that we should not attempt bone transplantation in acutely infected cases. It was that of a little boy who had his attack of osteomyelitis some six weeks previously. A large volume of the upper surface of the tibia was removed, and in order to expedite healing the gap was filled in with a graft from the opposite leg. Infection occurred, and the life of our little patient was threatened. The graft had to be removed in the course of about a month, but the patient ultimately recovered.

Whereas to-day nonabsorbable retentive material is being used very extensively in our bone work, especially in the use of the Lane plates in fracture work, time will demonstrate the advisability of using absorbable material wherever possible. It is highly probable that the future will demonstrate the use of bone plating rather than metallic plating in Lane fracture work. In the work of transplants it is often possible to dovetail the extremities and use chromic catgut.

Case 2, Plate 7.

Case 2, Plate 8.

Case 2, Plate 7. December 15, 1913. Showing fracture at upper end.

Case 2, Plate 8. February 27, 1914.

## CONCLUSIONS

First, the autogenous transplantation of bone is an established surgical procedure.

Second, whether dependent for growth on periosteum, or upon the graft as a scaffold for the development of blood-vessels, transplants for the present should be provided with both, particularly plenty of periosteum.

Third, nonabsorbable material had better be avoided wherever possible, dovetailing and absorbable suture material used in their stead.

Fourth, it is highly probable that organized bone tissue will in the future take the place of foreign material now used in the Lane plates for fractures.

Fifth, for the present a thorough applicability of heterogenous grafts has not been established.

Sixth, bone grafting should never be done in the presence of an active infection.

Seventh, most rigid asepsis should be exercised.

Eighth, bone-grafts owe their virility and ultimate success probably to the rapidity of blood-vessel development, plus the presence of osteoblasts wherever these may be.

Ninth, growth in the length of bone may confidently be predicted in the case of children when the epiphyses remain intact.

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# CONCERNING RENAL LESIONS AFTER PYELOGRAPHY [1]

By LEO BUERGER, M. D., New York City

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THE widespread employment of the method of pyelography in the diagnosis of lesions of the urinary tract at the present time, the value of the procedure and the current belief of its innocuousness, are circumstances that make it a duty — it seems to me — for those actively engaged in surgical work on the kidney, to record not only their successes with the method, but more particularly the dangers inherent in the work.

In December, 1911, on examining a kidney removed two weeks after collargol pyelography, I found distinct evidences of necrosis due to collargol in the renal parenchyma. These observations[2] were, however, not reported *in extenso*. Since then I used argyrol almost exclusively in this work, hoping that it might be less dangerous and less destructive of the renal tissue, even if it should penetrate into the renal parenchyma.

When, therefore, a few months ago, a case was encountered in which extensive necrosis occurred in a hydronephrotic kidney after the injection of argyrol into its pelvis, it seemed to me of some interest to record briefly the clinical histories and the pathological findings of both cases.

Case 1. S. K., female, seventeen years of age, had been operated on in October, 1911, for a ureteral calculus at the level of the fifth lumbar vertebra on the right side. For a long time a ureteral fistula remained, and evidently an inflammatory process with partial occlusion at the site of the ureterotomy, took place. For, ever since the patient was discharged from the hospital, she had pain in the right kidney, attacks of vomiting, and discomfort in the right side of the abdomen. In November, 1911, she was admitted to the surgical service of the Mount Sinai Hospital and Dr. Lilienthal requested me to make a cystoscopic examination.

The bladder was found negative, except that the right ureter was somewhat injected. In the right ureter an obstruction was met by the ureteral catheter 9 cm. from the ureteral orifice. Not even a No. 4 catheter could be passed. Indigo-carmine appeared in rather poor concentration after a lapse of seventy minutes. The urine obtained from the right side contained only 0.5 per cent urea.

A diagnosis of *ureteral obstruction* 9 cm. from the orifice, *pyelitis*, and slight hydronephrosis with diminished functional activity of that kidney, was made.

December 1st, 12 ccm. of collargol were carefully injected with a syringe, the catheter again meeting an obstruction at 9 cm. The X-ray picture showed a narrowing at a point corresponding to the point of ureteral obstruction, and also a shadow that was interpreted as being a pouch or diverticulum just above this point.

On December 15th Dr. Lilienthal exposed the ureter, with the view of performing a plastic operation, but found that the ureter was so embedded in inflammatory tissue over a considerable extent of its course that nephrectomy was considered advisable. This was carried out, and the kidney sent to the laboratory for examination.

*Macroscopic examination of specimen.* My notes on the gross appearance of the kidney were as follows:

The kidney is slightly enlarged with both the pelvis and the ureter moderately dilated and inflamed (Fig. 1). On stripping the capsule, the middle of the convex border and posterior surface show a number of blackish areas surrounded by slight congestion. These measure from four to eight millimeters in diameter, and correspond to wedge-shaped streaks of blackish color, ascending through the cortex about to the base of the pyramid. A smaller number of similar blackish areas are found along the convex border near the superior pole. Upon section of the kidney through these areas, a blackish infiltration is seen to extend about to the base of the papillæ, where they seem to taper to a point, their broadest extent being at the surface of the kidney. The tips of the papillæ and the corresponding calyces show no sign of collargol.

The smaller areas of blackish discoloration near the superior pole differ from those just described in that they do not seem to extend down very deeply into the kidney, occupying a position just under the capsule and extending into the cortex toward the papillæ for a distance of from

[2] Am. J. Urol., 1912, p. 166. Report of a meeting of the Section of Genito-Urinary Surgery, Jan. 17, 1912.

[1] Received for publication, May 5, 1914.

four to five millimeters. The papillæ and calyces corresponding to these are absolutely free, there being no infiltrated tissue underneath them. As far as can be determined by the naked eye there are no macroscopic purulent foci, but here and there small cysts.

*Microscopic examination.* Sections were cut so as to embrace the whole of the cortex and the papillæ of the kidney, containing areas of blackish discoloration, and others were taken as controls from other portions of the kidney.

The pathological changes may be divided into those belonging to the lesion which existed prior to the collargol injections, and those which appear to be due to the presence of collargol in the tissue. As for the former, the usual lesions that go with a moderate degree of hydronephrosis are in evidence. There is a moderate degree of parenchymatous nephritis, areas of fairly marked glomerular nephritis, chronic interstitial changes with connective-tissue production, and here and there areas in which the effects of back pressure manifest themselves in the form of distorted dilated tubules, bay formation, and cystic dilatation.

Collargol is present either in the form of black granules, or aggregations of blackish masses, or as very minute brown, yellowish brown, or blackish points, in spaces or in the bodies of cells. The largest amounts of collargol are to be seen distributed diffusely in areas that could be regarded as streaks in the macroscopic specimen, being distributed in tubules (Figs. 2 and 4), in cells, in glomeruli (Figs. 2 and 3), and in foci of necrosis and inflammation. Perhaps the most striking lesion is the presence of miliary abscesses almost wholly in the papillæ.

If, in such a section, we attempt to trace the passage into the kidney cortex of the collargol, we will find that the collecting tubules are but sparsely involved. Here and there the ascent of the collargol in the form of blackish masses completely filling the collecting tubules can be distinctly seen.

Where the renal tissue seems to be the most healthy, we are struck by the absence of collargol, or by the fact that but very few tubules are involved. Those areas of the kidney that are the seat of a chronic inflammatory process, however, seem to be most markedly invaded. If we follow the collecting tubules upward, we will see that areas in the cortex, corresponding to these, are frequently the site of collargol deposits, not only in the dilated tubules, but in the glomeruli themselves. In some of the tubules the collargol completely fills their lumina, in others the collargol is deposited in fine black, or yellowish brown granules, in hyaline or granular casts contained in the lumina of the tubules. It is strange to note that the glomeruli which are the seat of marked connective-tissue change and hyaline degeneration may also frequently contain collargol, the latter usually deposited in the form of a crescent, evidently in Bowman's capsule.

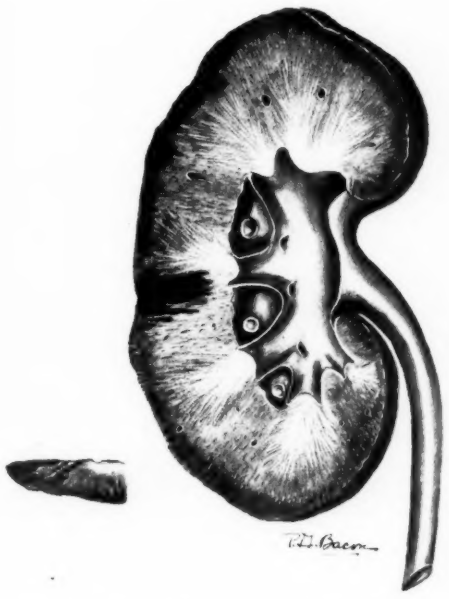

Fig. 1. Kidney in Case 1; areas of collargol infiltration seen in the surface of the section and in the small drawing removed for microscopic examination.

Where the collargol has reached areas of chronic productive inflammation of the kidney, there it seems to be deposited in the form of yellowish brown granules or larger masses that are partly situated in the renal tubules, but also in a large part seem to be taken by cells. Thus we find large aggregations of cells, filled with minute granules of this substance.

As for the abscesses, which were few in number, these contain a fair amount of collargol, some of which can be traced into straight and collecting tubules entering the purulent focus.

Special stains failed to demonstrate that any of the pigment, interpreted as collargol, indicated the presence of hæmosiderin.

Sections of the pelvis of the kidney in the neighborhood of the areas of collargol showed a moderate degree of chronic inflammation without any lesions such as ulceration and without any

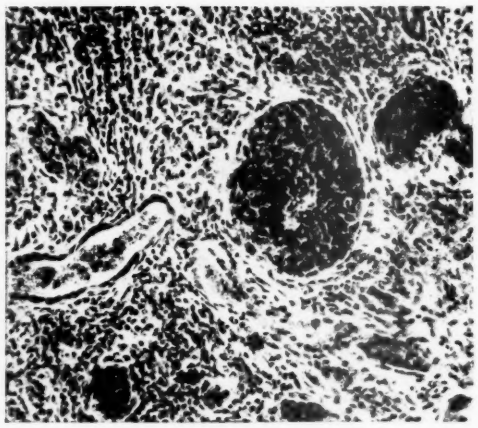

Fig. 2. Photomicrograph showing collargol in glomeruli and tubules. For the photomicrographs, I am indebted to Dr. F. S. Mandlebaum, Pathologist, Mount Sinai Hospital.

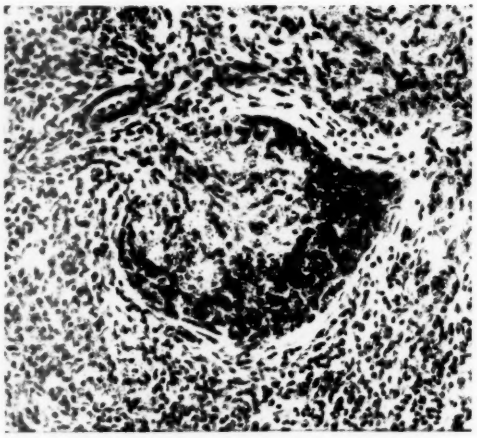

Fig. 3. Collargol in Bowman's capsule.

extravasation of collargol under the pelvic mucous membrane.

It is of interest to note that, where small amounts of collargol are present in the collecting tubules, or in the convoluted tubules, no necrosis is induced by its presence. Furthermore, this substance does not seem to have produced any marked inflammatory reaction in places where it is present in small amounts. On the other hand, in the region of the abscess, and where large amounts of collargol are present, evidences of inflammatory reaction can be detected. Whether this is to be interpreted as meaning that large amounts of collargol are necessary for the production of destructive and inflammatory changes, or whether these areas showing reaction are the seat of bacterial invasion, it is difficult to say. A striking fact, however, is the absence of marked necrosis and inflammation wherever a small amount of collargol is present.

This case demonstrates conclusively that collargol when injected into the pelvis of the kidney for purposes of pyelography, can enter the parenchyma where it may be demonstrated not only in the collecting tubules but also in the stroma, connective-tissue cells, and glomeruli, invading the cortex as far as the capsule of the kidney.

Case 2. Male, 36 years of age, admitted to the genito-urinary service of the Mount Sinai Hospital on February 12, 1914, for prostatic abscess and a mass in the region of the right kidney. For some five years the patient had had attacks of pain in the right lumbar region, shooting up into the chest and back. Some of these were attended by fever, others were so mild and indefinite that a positive diagnosis had not been arrived at up to the present time. On admission to the hospital, the patient was tender upon deep pressure in the right hypochondrium, there was marked rigidity of the right rectus muscle in this region, and in the X-ray picture a very distinct, enlarged renal shadow could be seen. The tentative diagnosis was hydronephrosis with marked perirenal inflammation, as indicated by the intense rigidity of the right rectus muscle.

Cystoscopic examination, February 20th, showed that the function of the right kidney was at least temporarily impaired, the urine showing a few clumps of white blood cells.

On February 24th a catheter was introduced into the pelvis of the right kidney, and about 20 ccm. of a 40 per cent argyrol solution were very slowly and carefully injected by an assistant, a pyelogram being taken immediately afterwards. The radiogram (Fig. 5) showed a considerably enlarged renal pelvis, with the usual changes of the renal type of hydronephrosis.

A very few hours after the injection of argyrol, the patient complained of severe pain in the right lumbar region, the temperature rose to 102° F., and there was considerable distress for twenty-four hours. The temperature gradually fell, so that on the third day succeeding the argyrol injection, the patient was already comfortable. Another X-ray taken on the 28th of February, four days after the argyrol injection, to determine whether the pelvis was completely empty of its argyrol contents, showed no visible argyrol in the pyelogram.

On the 4th of March, I explored the right kidney through the usual oblique lumbar incision, and found an enormous kidney, intensely adherent, with all the evidence of a perinephritic inflammatory process of long duration. Because of the enormous size of the kidney, and for fear that the left kidney might not be adequate, or possibly was of the infantile type, it was deemed wise to explore further before deciding upon nephrectomy.

Upon opening the capsule of the kidney, and exposing the cortex, the parenchyma was found intensely congested, presenting on its surface small areas of greenish black discoloration. Two small pieces were removed for microscopic examination, both of these being taken through parenchyma that was evidently the seat of necrosis and blackish discoloration.

A rubber tube was inserted into the pelvis, and the kidney drained. The further course was uneventful. The kidney became smaller, a renal fistula remaining for five weeks; spontaneously closing. The patient left the hospital free from renal symptoms.

*Microscopic examination.* In this case sections were only made from the two small pieces of tissue taken from the cortex of the kidney at the time of the nephrotomy. On gross examination these appear to be made up of congested, bluish black, somewhat œdematous renal tissue, in which there are streaks of necrosis, together with black pigmentation.

Histological examination shows, here also, the presence of two lesions — first, the lesions belonging to the hydronephrotic condition of the kidney, and second, the changes associated with the presence of argyrol.

The chronic changes in the renal tissue are somewhat more marked in this case than in the last, there being a more extensive involvement of the tubules, more dilatation of these, more atrophy, and more interstitial and parenchymatous nephritis.

The important lesion, and that apparently associated with the presence of argyrol in the tissue, is extensive necrosis giving the picture of an anæmic infarct, in which diffuse infiltration with argyrol is a feature. In these infarcted or necrotic areas only the shadows of glomeruli, convoluted tubules, and interstitial tissue can be discerned, but their structure is sufficiently evident to enable one to discern clearly their relation to the argyrol deposits. Although argyrol cannot be detected in all parts of the areas of necrosis, it is to be found in sufficiently large quantities to arouse the suspicion that the infarction or necrosis is directly due to the drug.

For the most part, the drug is present in the form of black pigment in the lumina of the tubules, in the glomeruli, in the necrotic interstitial tissue, and in the areas of exudate bordering on the zones of necrosis. In other places argyrol seems to be present in the form of brown coloring matter that impregnates the coagulated cells of the tubules. Here a sort of ringlike brownish mass represents the remains of the tubules.

The most striking lesion is found in those areas in which the interstitial tissue is diffusely infiltrated with the drug, the stroma staining diffusely as a golden brown network surrounding the urinary tubules. In such areas there can be no doubt as to the nature of the discoloration.

It is evident, therefore, that argyrol of 40 per cent strength, when injected into the pelvis of the kidney, may find its way into the parenchyma

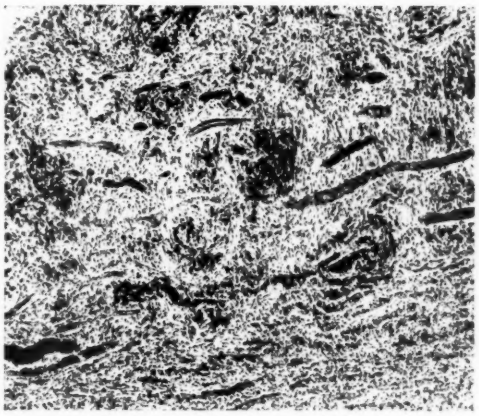

Fig. 4. Collargol in collecting tubules and in cells in inflamed stroma.

where it may diffusely infiltrate the interstitial tissue with a golden brown stain, or where it may become deposited in the form of black or brownish black pigment in the tubules, in the glomeruli, or in the stroma.

Although the invasion of the renal parenchyma by the silver salts was apparently not dangerous to life in either case, and although the appearance of the kidney in the first case, and the clinical course in the second, speak for the possibility of recovery from the necrotic lesions, nevertheless the circumstance is sufficiently grave to warrant careful analysis, with a view to avoiding, if possible, its occurrence in the future. The following questions seem worthy of consideration:

1. Is the infiltration of the parenchyma with silver salts influenced by the technique employed?
2. How do the silver salts enter the parenchyma?
3. How are the abscesses brought about?
4. Why do collargol and argyrol cause necrosis in living tissue which under ordinary circumstances, does not seem to be seriously influenced by these drugs?

As for the first query, it seems scarcely probable that the entrance of the silver salt into the tissue is influenced by the technique employed. It is true that in both instances the fluid was injected by means of a syringe and not by the gravity method. However, the injection was so carefully and slowly made, and the amount used, in the first case at least, so small (12 ccm.), that the initial force of injection could hardly be held responsible.

A study of the infiltrated areas brings to light

Fig. 5. Pyelogram of kidney in Case 2, showing renal type of hydronephrosis.

the fact that although the interstitial tissues also harbor the silver salts far up in the cortex, most of it must make its way upward through the urinary tubules. In Fig. 4 the straight collecting tubules are seen filled with collargol, and it may be assumed that many more of these collecting tubules had previously contained the salt. Many of these can be directly traced into the necrotic and purulent areas containing fairly large amounts of black substance.

The cause of the development of the abscesses encountered, particularly in the first case, is not easily explained, for it is not certain as to whether small inflammatory foci were not already present before the injection.

In the second case the inflammatory areas bear a more definite relation to the areas of necrosis and argyrol penetration, so that little doubt exists as to their causation. It is more than likely that a stage of primary necrosis precedes the abscess formation. The development of abscesses depends, it seems to me, on secondary invasion with organisms possibly carried in from the pelvis by the ascending silver salts. The assumption that the areas of necrosis can remain aseptic and bacteria-free, is strongly supported by the fact that the kidney of Case 2 apparently healed out completely, although extensive necrosis was present.

Finally, as to the reason for necrosis, it would appear more than likely that several factors in addition to the presence of the silver salts are responsible. Thus in both cases there was marked impairment to the outflow of the silver salt, so that its retention was favored: in the first case by reason of an ureteral stricture, in the second case by the very same cause that had produced the hydronephrosis — an obstruction at the ureteropelvic junction (Fig. 5). Added to this factor, we may assume that late contractions of the renal pelvis — as they are manifested in the renal colics following the pyelography — may be instrumental in furthering the ascent of argyrol or collargol into the parenchyma when its descent into the bladder is prevented. Given the retention of the salts and their entrance into the renal tissues, an additional circumstance must be sought to explain the necrosis. A not unimportant predisposing factor, and one which is demonstrable in many sections, is hæmorrhage. That the penetration of silver salts into the tubules and interstitial tissues may be accompanied by hæmorrhagic extravasation, may be accepted without hesitation.

May not another reason for the necrosis be found in the lessened resistance of an inflamed or congested renal parenchyma? In Case 2 the extensive perirenal inflammation and the intense stasis due to the ureteral obstruction doubtless contributed toward the production of a congested parenchyma; and in Case 1 similar conditions were at work.

## CONCLUSIONS

1. Collargol or argyrol when injected into the renal pelvis for purposes of pyelography may penetrate into the renal parenchyma as far as the surface of the kidney.

2. Extensive necrosis and suppurative foci may be the consequence. Aseptic foci of necrosis may heal, all renal symptoms disappearing.

3. Interference with the outflow of the silver salt, inflammation or congestion of the renal parenchyma, are predisposing factors in the production of the necrosis.

4. Our endeavors should be directed toward evolving methods for the prevention of this untoward complication. Thorough evacuation of the renal pelvis through the ureteral catheter, aided by irrigations with saline solution or boric acid whenever spontaneous drainage does not occur, may be regarded as precautionary measures hat should be employed in every case.

# IMMEDIATE BONE TRANSPLANTATION IN COMPOUND COMMINUTED FRACTURE OF TIBIA AND FIBULA

## One of the Fragments Used for a Transplant

By WALTER S. BARNES, M. D., Chicago
Attending Gynecologist, Mercy Hospital; Assistant Professor of Gynecology, Northwestern University Medical School

THIS is the era of transplantation in surgery. Fascia and other tissues and numerous foreign substances have been transplanted for various purposes and no one can foretell what the final possibilities of transplantation really are. The case which I report herewith has, I believe, opened up another field for transplantation and, so far as I can learn, there is no other similar case on record. It is for that reason that I report it. Furthermore, the outcome was such an extraordinarily gratifying one that I believe it will surely serve as a means of encouraging others to try the same procedure in similar cases, thereby saving limbs.

We must confess that in many of these cases an amputation is performed, and perhaps at the time that might seem to be the best procedure; nevertheless, there can be no doubt that in a considerable proportion of these cases a transplantation, such as was carried out in my case, is a perfectly feasible procedure and one which should at least be considered before an amputation is done. Furthermore, it not only saved the patient's foot in our case, but gave her a useful foot. The case was as follows:

Female, age fifty-nine, housekeeper, married, never had any serious illness, was brought to the hospital because of a broken ankle, September 4th. While crossing the street, just after alighting from a street car, the patient was struck by an automobile truck, thrown to the ground, and one wheel passed over her left leg just above the ankle. She was immediately taken to the hospital and examined by Dr. Frost, who referred the patient to me later. He found that she had a compound comminuted fracture of the left tibia and fibula about two inches above the ankle joint, with several spicula of bone protruding through the skin. There were also several contusions on the left side of the head, shoulder, and hip.

The wound and a considerable area around it was at once painted thoroughly with tincture of iodine and dressed with sterile gauze. The leg was placed in an ordinary box splint. Fearing the possibility of a tetanus infection, fifteen hundred units of antitetanic serum were administered hypodermatically.

On the following morning röntgenograms were made of the leg. The anteroposterior view showed apparently a normal ankle-joint; that is, the articular surfaces of the tibia, fibula, and astragalus were normal and in normal relationship to each other. The fibula was fractured about two inches above the tip of the malleolus. The upper fragment was overriding the lower fragment for a distance of about an inch. The tibia was comminuted about two and one-half inches above its lower articular surface for a distance of about five inches. The bone was partially splintered, and a lateral view of the ankle showed that the fragments were also in malposition to the shaft of the bone as well as with each other. (Figs. 1 and 2.)

I saw the patient for the first time on September 7th. After examining the röntgenograms very carefully, I came to the conclusion that it would be worth while to try to reduce the fracture, admitting, however, that it might be necessary to perform a more extensive operation. The patient was anæsthetized and the entire foot and leg up to the knee were painted with iodine. An incision was made on the anterior surface of the leg, just to the inner side of the crest of the tibia, connecting the two openings from which fragments of bone had been protruding. The skin edges were badly crushed. These were very carefully trimmed off, so as to give not only a smooth surface for a subsequent approximation, but also to remove any infected material which might have been ground into these skin surfaces at the time of the accident. Two protruding fragments of bone were lifted out of the wound with tissue forceps and were found to be unattached and free of periosteum.

Further examination of the deeper layers of the wound revealed many small fragments of bone lying free in the tissue and apparently without any periosteal covering. All of these fragments were removed. One fragment, which measured five and one-half inches in length and about the thickness of an ordinary sized man's little finger, was placed in sterile salt solution to be put to some use later, because during the course of the operation thus far the thought occurred to me that I might use some of this bone for transplantation purposes, because about five inches of the shaft of the tibia had been crushed and if the ends of the two fragments were brought together, the leg would be just that much short; therefore, when I removed this large fragment, I at once thought of the use to which it might be put. It was sufficiently long to span the gap between the two fragments.

All the loose bone was removed from the wound. Bleeding points were looked for, but none were found. The anterior tibial artery and vein had escaped being injured.

The large fragment of bone, which had been placed in salt solution immediately on its removal, was now carefully trimmed so that all the ragged edges were smooth, and it was placed in the gap between the two fragments, each end resting securely in the medullary canal of the fragment. The lower end was quite firm, but not so the upper. In order to give additional support to the upper end, a double loop of No. 2 chromic catgut was thrown around the fragment of the tibia and the transplant, and likewise one loop around the lower fragment and the transplant.

This gave us a good and a secure fixation of the transplant, which, as said above, was not covered by periosteum. Nothing was done with the fibula. The fragments were in good apposition and we felt that it was wise to leave well enough alone, because of the extensive injury of the tibia and because we realized that we could not state positively whether all the infectious material had been removed from

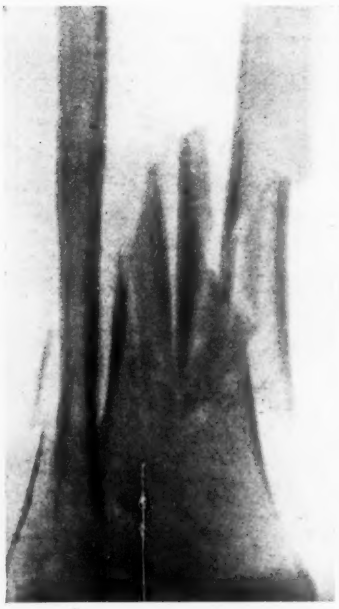

Fig. 1.

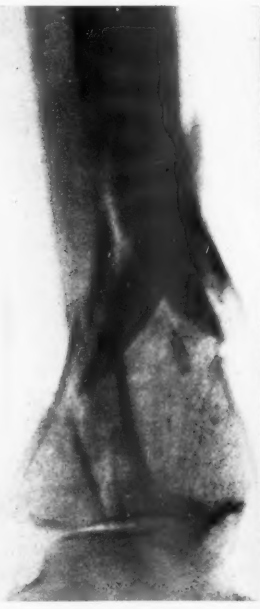

Fig. 2.

Fig. 3.

Fig. 1. Compound comminuted fracture of the tibia and fibula involving about five inches of the shaft of the tibia. The fibula fragments are in contact but overriding. The outer shaft fragment of the tibia is displaced inward and the ankle-joint appears to be normal.

Fig. 2. Lateral view showing malposition of the fragments and also the overriding of the upper fibula fragment. There is a long thin spiculum of bone protruding upward from the lower fibula fragment.

Fig. 3. Röntgenogram made the day after the operation. The transplant was driven down into the lower fragment and was little more than contacted with the upper fragment, contact being maintained by means of loops of catgut thrown around the shaft and transplant.

the wound, although every precaution had been taken to do so. The entire procedure was in the nature of an experiment which we felt was justified when the case was considered in its various aspects.

The soft tissues were then allowed to fall together and the skin and fascia were sutured with silkworm gut, although the edges of the wound could not be brought together on account of the great loss of tissue. The cavity filled itself quite naturally with a blood-clot and it proved to be an excellent filling material. In order to prevent a shortening of the leg, which might be caused by the contraction of the tendo Achillis, this was divided transversely and subcutaneously. That left the foot free from all traction from above.

Here, then, we had an auto transplant taken right from the same bone into which it was transplanted. The transplant was free of periosteum and we were not absolutely sure of its asepsis, but we were well aware that if the experiment proved a failure, we could make another transplantation later, taking bone from the crest of the other tibia, or an amputation could be done, if it became necessary. (Fig. 3.)

The wound was dressed with dry sterile gauze and a posterior plaster of Paris cast was applied extending from the toes to well above the knee, the foot being held at right angles to the leg and slightly adducted, thus tending to separate the fibula fragments and giving additional security to the transplant.

The subsequent course of the case was, as far as the operation is concerned, rather uneventful. The patient's temperature never rose above one hundred and the highest pulse was ninety-six,—rather a gratifying course in a case of this kind occurring in a patient fifty-nine years of age. The first dressing was made on the tenth day. There was a very slight discharge of serum from the wound. Within three weeks the entire wound had healed by primary union. Unfortunately for the patient, she developed a hypostatic congestion of the lower lobes of the lung at this time, from which, however, she made a good recovery. She left the hospital at the end of nine weeks still wearing a light plaster of Paris cast on the ankle.

Röntgenograms were made about nine weeks after the operation and we could not feel otherwise than pleased with the progress of the case. The leg and foot were plumb, the fibular fragments had united firmly, the transplant was doing its work well, and union had already taken place between the ends of the transplant and the tibia. (Compare Figs. 3 and 5.) There was a consider-

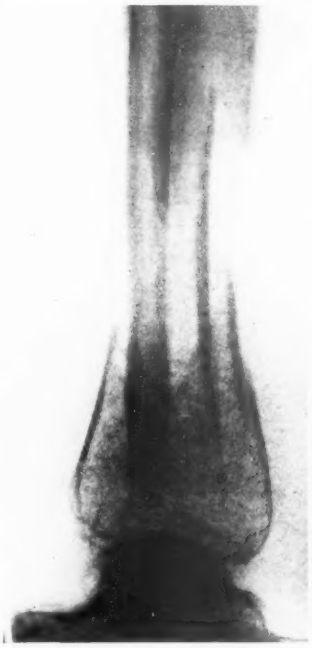

Fig. 4.

Fig. 5.

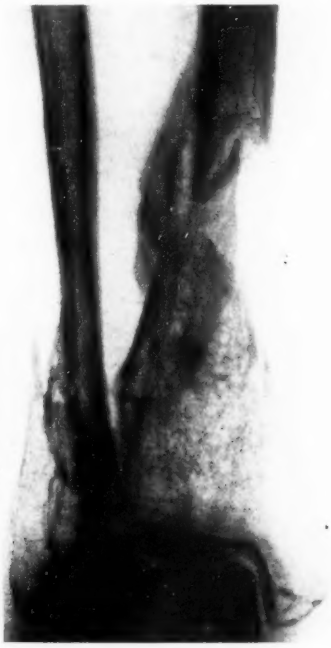

Fig. 6.

Fig. 4. Lateral view showing osteogenesis progressing between tibia fragments and showing a good approximation and alignment of the fibula fragments.

Fig. 5. Nine weeks after the operation. The osteogenesis had progressed to a considerable degree. The lower end of the transplant is firmly united with the lower tibia fragment and the upper end has also become similarly united to the tibia fragment. Comparing with Fig. 3, this is shown very well. New bone has bridged across the gap from the transplant to the tibia on the inner side. The ankle-joint is normal, although there is a slight adduction of the external malleolus.

Fig. 6. Eighteen weeks after the operation. The bony union is firm and there is a considerable deposit of bone on the outer surface of the transplant reaching over into the tibia. The strip of periosteum attached to the tibia above and lying free in the wound might have something to do with this bone deposit.

able deposit of bone extending from the outer surface of the transplant at about its middle up onto the tibia, and when it is remembered that young bone or osteoid tissue does not give a shadow with the röntgen ray, it will be appreciated that there was much more bone in the process of forming than was shown in this röntgenogram. The lower end of the transplant had become so thoroughly united with the lower tibia fragment that its outlines were lost. A lateral view (Fig. 4) shows that there is no deformity of the ankle or leg and the alignment of the bone is perfect. By comparing this picture with Fig. 3 the progress made by the new bone formation is apparent.

A second set of röntgenograms was made about eighteen weeks after the operation (Fig. 6). The bones are now solid. The union between the tibia and the transplant was firm and complete and was still progressing. Seven months after the operation regeneration of bone was still taking place. The transplant is disappearing by absorption and new bone is taking its place. (Fig. 8.)

There are several points in connection with this case we wish to emphasize. First, the nature of the fracture, a compound comminuted fracture occurring under circumstances which would naturally lead one to infer that an infection must have taken place. Second, the age of the patient. She was no longer a young woman, but was of an age at which regeneration of tissue does not progress rapidly, as a rule, nor is the resistance of the tissues high. Third, we made use of a transplant which was removed from the wound and which was not known to be aseptic; in other words, in which there lurked the possibility of an infection. Fourth, the transplant did not have

Fig. 7. Fig. 8.

Fig. 7. Lateral view showing normal anatomic relationship between tibia and astragalus and a perfectly straight leg. Note the bridge of bone between the fibula fragments at A.

Fig. 8. Skiagram made seven months after the operation. The identity of the transplant is being lost, although its outlines are still to be detected. New bone is still forming on the inner side of the tibia. The union is solid.

any periosteum on it. Fifth, the comparatively rapid regeneration of the bone, union having taken place nine weeks after the operation, the union being well-nigh perfect eighteen weeks after the operation, the new bone being of the same thickness as the old bone. Sixth, while this patient suffered a pulmonary infection shortly after the operation, metastasis of the infective products into the transplant or wound did not take place. Seventh, we cannot fail to mention in this connection that while the transplant was devoid of periosteum, the bed in which it was placed may have been the periosteal bed of that portion of the shaft of the tibia which was shattered by the trauma. Still, a very careful examination of the röntgenograms made after the operation failed to show anything which might be construed as periosteum, and, therefore, we feel that the osteogenesis took place entirely from the tibia fragments, passing from one to the other through the haversian canals of the transplant.

Fig. 9. Patient's foot as it was eighteen weeks after the operation.

It is not our purpose at this time to discuss the merits of the case from this point of view. We merely wish to report the case to give encouragement to others to carry out similiar procedures.

# THE USES OF AN ARM–BOARD IN SURGERY

By G. GREY TURNER, M. S., F. R. C. S., Newcastle-upon-Tyne, England

To obviate the necessity of having a special assistant to hold the arm in operations for cancer of the breast I hit upon the idea of using an arm-board, such as is employed in our dissecting rooms. This simple device has been so useful that I think it is worthy of attention.

The board which I employ is shown in photograph, Fig. 1. It is made of soft wood five-eighths of an inch thick, measures four feet in length, is five and one-half inches wide at one end and three and one-half at the other. The broad end is beveled so as to form a long, thin wedge while the notches at the narrow end are for fixing the bandage to keep the arm in position.

The beveled end of the board is pushed under the sheet on which the patient lies, and between it and the top of the table, so as to project away from the side of the latter for any convenient distance. A folded towel is laid on the board and the arm fixed by a turn or two of bandage, care being taken not to apply it too tightly.

With the arm on the board the position of the latter can be readily altered as often as may be necessary, during the course of an operation, and without disturbing the towels, etc.

Fig. 2 shows the arm arranged as for excision of the breast. The sterilized towel is fixed over the arm with metal trouser clips such as are used by cyclists. They surround the arm and get a hold on the edges of the board in addition. The simple anæsthetic screen which I described in the British Medical Journal[1] is shown in position, the towels being fixed to it by a couple of ordinary tie clips.

The whole arrangement is exceedingly simple and satisfactory and has the great virtue that it can be applied to any form of table and at any part of the table, and can be altered by the surgeon during the course of the operation without trouble.

[1] February 24, 1912.

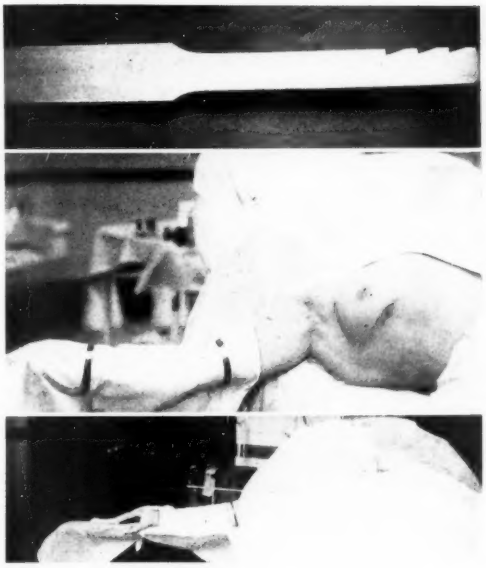

Fig. 1. The Arm-Board.
Fig. 2. The board supporting the arm in amputation of the breast.
Fig. 3. The board supporting the arm for an operation on the finger.

The third photograph shows the board arranged for an operation on one of the fingers. Though useful for many purposes, it is especially convenient for any interference in the neighborhood of the axilla. Having now used the arm-board for about three years, I have come to look upon it as an essential part of our armamentarium and can recommend it with the greatest confidence as to its utility.

# THE TREATMENT OF CRANIAL DEFECTS BY BONE-GRAFTS [1]

By ROBERT L. RHODES, B. A., M. D., Roanoke, Virginia

THE subject of bone surgery has attracted wide attention during the last few years and the literature is quite voluminous with newer ideas and advances as well as repetition of older thoughts.

The application of bone-grafts to cranial defects is by no means a recent thing, but as with grafting in general it is attracting more attention now than at any time previously. Jobi Meekren in 1682 replaced a cranial defect with a piece of dog's skull which healed in perfectly. He, however, was forced by the Church to remove the graft under ban of excommunication. Among those who have replaced bony buttons or chips into cranial defects with successful healing, Janeway (1) cites Kuester, Von Jaksch, Watson, Pike, Gerstein, William Jones, Von Bramen, Weir, Moller, Eastman, Bunge, and Macewen. Since then Röpke (11) has transplanted a chip from the scapula into a cranial defect.

So far as I can find, there are no cases of large total graft to the cranium which makes these cases more interesting.

The following cases were patients in the Jefferson Surgical Hospital in the service of Dr. Hugh H. Trout. Each presented symptoms referable to the brain and mostly those of pressure. In all there were definite cranial depressions, and in two the X-ray showed the presence of spicules of bone pressing against the brain substance.

Certainly there were indications for the relief of pressure. The idea of the graft was the hope that it would prevent an overgrowth of bone, especially down in the cranial defect and preclude the return of symptoms. This was particularly desirable since Case 1 was having much trouble within one year from his injury.

Case 1, R. L. B., a man thirty-seven years of age whose general health had always been good until one year ago (March 24, 1912), when he was shot, the bullet entering the right parietal bone and lodging in the brain substance about two inches from the point of entrance. A piece of bone about 1 cm. in diameter was carried in a distance of about one inch. The X-ray showed both the bone and the bullet, and both were readily removed at operation the next day. Convalescence was uneventful during his stay in the hospital, from which he was discharged April 10, 1912. He returned to the hospital March 20, 1913, when he gave history as follows: Since leaving the hospital the patient has worked most of the time till March 17, 1913, when he was forced to stop. During this time he has had many attacks of severe pain in the left side of his back just below the costal margin. There is no relation of pain to exercise. Last week he had severe pain at the site of the old head wound. The pain was drawing in character and seemed to affect his mind. He says his head feels like it was full of water; fries and bubbles like one in swimming. There was no nausea or vomiting; his general health good, has had several hard convulsions recently which are becoming more frequent. He does not lose sphincter control during the attacks. Always has severe headache following, and feels dull and stupid. His wife thinks he is not as bright as formerly, that he has no memory, is more nervous, and has to void quite often at times.

Physical examination was practically negative, but the X-ray showed an excess of bony growth at the old wound and with spicules on the inner side. He was advised to have the wound opened, the excessive growth removed, and a graft from the tibia placed in order to lessen the likelihood of its re-forming.

Case 2, J. C. R., is that of a man forty-two years of age who complained of convulsions. His family history was negative—no epilepsy or other nervous disorders.

Present illness. About twenty years ago patient was accidentally struck on the occipital region of the head with a hoe by his sister. A large gash was cut, but no other effects till about sixteen years afterwards when patient began to have convulsions. At first these attacks were quite mild and infrequent, only one or two a month. They have become more and more frequent and severe with each attack. At present, he has two to four a week; at first they were only in the daytime, but recently they have occurred at night as well. During attacks the patient vomits and often expectorates blood at the same time. The patient often fell in the daily attacks and injured himself. There has been no bowel incontinence, but has voided during attacks at times.

Recently, following the convulsions, he has severe pain in the back of his head, neck, and right shoulder. Four weeks ago he had an attack of severe pain in his left side which wore off gradually.

Physical examination: There is a scar and depression in the occipital region on the right side about one and one-half inches by one inch in size. Pupils sluggish. The patient has a dull, stupid appearance and sluggish mentality. When asked a question he stares at you and finally answers in a short, snappy way. His speech is somewhat scanning and slurring, with a muffled sound. Articulation not distinct. There is a hesitancy in his speech at the first utterance and then a running, as if he could not speak fast enough. Otherwise his physical condition is very good. The X-ray showed a depressed fracture at the site of the old injury with spicules of bone pressing against the brain substance.

Patient was allowed to go home April 15, 1913. He had had two mild convulsions of only a few minutes' duration since operation. Many of his friends, his wife, and father noticed the improved mentality, that he was much brighter, answered questions much more readily, and apparently was very much improved. In spite of advice to the contrary he was out on the streets frequently, laughing and talking, and on one such occasion he had a convulsion, fell and broke his leg at the upper end of the site from which the graft had been removed. He returned to the hospital where the fracture was reduced and a vanadium steel plate used to hold the fragments in position, this being before we began the use of autogenous bone-grafts and nails in the treatment of fractures.

[1] Read before the Southwest Virginia Medical Society, Roanoke, Virginia, June 3 and 4, 1913.

Fig. 1. Case 1. Showing the original injury, both the bullet and piece of bone in the brain substance. Coil of wire marks the point of entrance.

It was very interesting to find at this operation the amount of new bony tissue present and evidently coming from the bone itself, since the periosteum had been previously removed, nor was there any sign of its bridging across, the edges being just as left at the previous operation.

CASE 3, L. B., is that of a young man seventeen years of age who gave the following history: Complaint, stiffness of right leg and difficulty in walking. Family history and past history, negative. Present illness: Seven years ago the patient was struck on the head (left parietal bone) with a stone. The blow knocked him down but he got up immediately and walked to the house—a distance of thirty-five or forty yards. The patient stayed in bed for one week and then began to walk around.

About one week after the injury the wound began to bleed profusely and continued to do so frequently during the next three months, so that he was continually kept very weak and pale.

The first solid food which he took (three months after accident) caused him to have a series of convulsions over a period of twenty-four hours. He was then operated upon and a part of the parietal bone removed and an abscess the size of a hen's egg was opened and drained. From this time he began to improve and regain his strength. Four years after the accident his friends noticed that he threw his right leg slightly outward, describing a small arc in walking. This gradually became more noticeable, the toes of his right foot began drawing downward, the entire foot being flexed plantarly till he had to use crutches. After several months the foot straightened out again and he discarded the crutches.

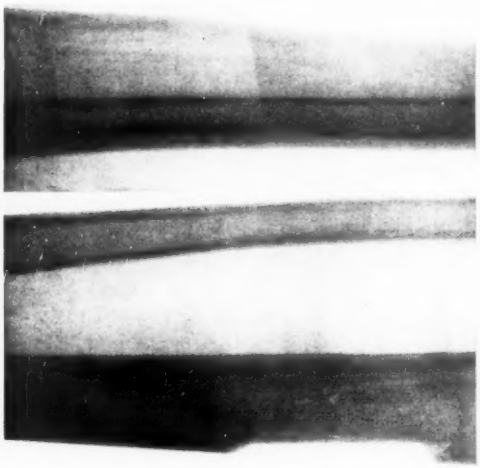

Fig. 2. Case 2. Showing front and side view of tibia from which the graft was taken. Fifteen days after operation.

About one year ago his foot began drawing downward, gradually at first, but has rapidly increased during the last four or five months. There is no subjective disturbance of sensation in his foot or leg. He has not had a convulsion during the last six and one-half years nor a headache. Occasionally upon lying down he feels as though he were in a swing and can feel the blood pulsating near the old scar in his head. X-ray showed a depressed fracture.

Fig. 3. Case 2. Showing graft in position. There is definite new growth of bone between the graft and the skull at the points of contact. No evidence of new growth at the end of the graft or at site of the overlapped periosteum. Fifteen days after operation.

Fig. 4. Case 2. Nine months after operation showing line of healed fracture (upwards and backwards towards fibula); evidence of the screw holes used with the steel plates; excessive amount of callus; site of the removed segment of bone completely healed and yet the periosteum was removed with and for a distance of 1 cm. around the graft. Second operation (to apply the plate in treatment of the fracture) showed the presence of new bone but the edges of the periosteum as left at the first operation.

*Operations.* In each case the depressions were opened up and all depressed bone removed, care being exerted to remove all spicules pressing against the brain substance and smooth the under surface of the cranium. Exploration failed to show the presence or suggestion of a tumor. Scar tissue and adhesions were freed as well as possible.

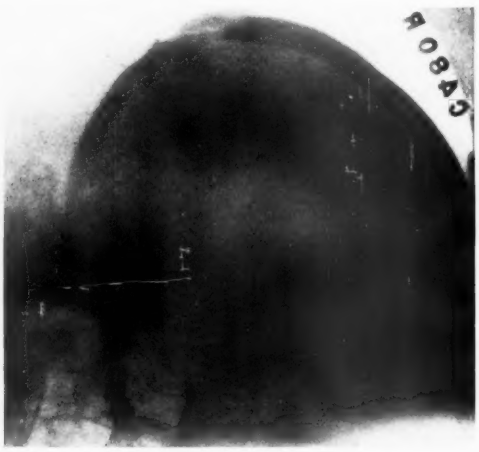

Fig. 5. Case 2. Nine months after operation. The position in this picture is slightly faulty in that the graft is not directly in line such that only one edge is shown. However, it shows the graft in position and anchored to the cranium, and the defect in the latter healed across with no evidence of bone growth inwards; nor is there any suggestion here that the periosteum has played any part in the regeneration of bone.

Fig. 6. Case 3. Showing the graft in position and the presence of new growth of bone between the graft and the cranium, but no evidence of bone being thrown down by the overlapped periosteum. Fourteen days after operation.

A rectangular piece of bone large enough to cover the cranial defect was in each case taken from the flat surface of the tibia along with the periosteum covering and slightly larger than the graft and placed over the defect and anchored in position by sewing the periosteum of the graft to that of the skull with chromic catgut. The bone was full thickness and included a little marrow under the surface. Scalp closed snugly over this with heavy black silk sutures.

In each case radiographs were taken about two weeks after the operation and show apparently a growth of bone between the under surface of the graft and the skull and no suggestion of new bone being thrown down by the periosteum. The periosteum was taken with the graft so as to anchor it in position.

The periosteum was removed from the tibia in each case, so that here we shall see whether it is necessary for regeneration or if the bone itself and alone will bridge over the gap, and if so, if there will be any overgrowth because of the absence of the periosteum and its function as a limiting membrane.

SUPPLEMENTARY

CASE 4. C. L. S., age 36. Complaint, convulsions. Family history and past history, negative. Present illness: Twenty-six years ago patient was struck over the left parietal area by a falling limb, sustaining a fractured skull, and a portion of his brain escaped. He was unconscious for twenty-six hours and for fifteen days was unable to speak

and for several months speech was halting and slow. He was generally incapacitated for mental work for eight or ten years. During the past sixteen years he has periods of obsessions—a desire to commit murder and occasionally suicide, and he feared he would commit such, though he has never done anyone any harm. His memory has been poor ever since injury.

In November, 1912 (eight months ago), he had a convulsion of the right side of the body after he had gone to bed. Suddenly awakened with peculiar sensation in his head and with things black before his eyes, though there was a light in the room. He was unable to speak and his mouth and head were drawn to the right. After several minutes he staggered across the room and then lost consciousness for about fifteen minutes. Following this for several weeks he was partially paralyzed, and then began to regain motion so that he was able to walk after a few more weeks. In February, 1913 (five months ago), he had a similar attack, though paralysis or muscular weakness was not so marked. The third attack was four weeks ago and worse than the two previous. Frequently during the last six or eight months he has been unable to open his right eye.

Physical examination revealed a scar following the temporal suture on the left side and a depression of the bone beneath. The left half of the cranium seems considerably fuller than the right. The extra-ocular movements good. There is some break in convergence. No nystagmus, no exophthalmos. Deep reflexes somewhat exaggerated on right side. Oppenheim and Babinski reflexes absent. No ankle clonus. Otherwise, examination negative.

X-ray showed a jagged fracture over left parietal region with depressions at several points and an absence of cerebral tissue just beneath the fracture. There is also a depression in the frontal bone.

Operation was practically the same as in the preceding cases except that about two ounces of clear fluid was evacuated from a pocket just beneath the depression. In following the contour of the skull it was necessary to employ two transplants, one being about one by one and one-half inches over the frontal opening and the other one by two and one-half inches over the temporofrontal opening.

Over eight months have elapsed since the operation and the patients remain very much improved. Case 1 is practically cured. Case 2 very much improved, having an occasional convulsion, usually associated with constipation. With close attention to his bowels he has not had one for over three months. His mentality is as good as several years ago and he is back at his work, a clerical position. Case 4 has gained twenty pounds in weight and is free from symptoms except an occasional convulsion. Six in all since operation. Case 3 has moved from this territory and I am unable to get a reply to my letters.

### CONCLUSIONS

1. The total graft is a means of covering cranial defects made for whatever cause; that it lessens the likelihood of spicules of bone growing downward as when the skull is left open.

2. That the regeneration of bone takes place independently of the periosteum as illustrated by the growth of bone between the graft and the skull and in the tibia from which it had been removed.

3. The periosteum is an excellent means for anchoring a graft in place.

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## PULMONARY ABSCESS

By A. Howard Pirie, M. D., Montreal, Canada

During the past year I have had to do with five cases illustrating the value of X-rays in the diagnosis and treatment of abscess in the lung. Three of these cases were shown by X-rays to be suitable for operation. Of the remaining two, one was also suitable, but this case was complicated by the presence of tubercle bacilli in the sputum. The fifth case presented the clinical signs of abscess, but X-rays demonstrated that operation was not indicated, as no localized collection of pus was present, but rather a large dense area corresponding to a gangrenous lung. In the latter case operation was followed by death. In the first three cases recovery followed operation, with gain in weight in each case. The case of abscess accompanied by extensive tuberculosis was not treated.

A plate of the chest made with the patient in the horizontal position is useless for the diagnosis

of abscess. He must be erect, and the horizontal ray must pass through the upper level of the pus in the abscess cavity. This upper level of the pus gives a horizontal line which is pathognomonic when it is confirmed by a plate made with the patient lying on his side. In this position the fluid remains horizontal but is parallel with the spine, whereas when the plate is made with the patient erect the shadow of the horizontal line is at right angles to the spine. The horizontal ray must be used in each case, passing through the upper level of the fluid. (See radiographs.)

The following is a short account of two cases of pulmonary abscess illustrating the value of X-rays in diagnosing and localizing abscess.

CASE 1. H. P., age 19, under Dr. Hamilton, Royal Victoria Hospital, Montreal; admitted December 4, 1913, complaining of cough, foul-smelling and bloody expectoration, with pain in right axilla. Teeth extracted under gas six weeks ago. Pain in right axilla followed two weeks after extraction, accompanied by cough, followed in a few days by foul-smelling expectoration, and five days before admission by fever, fast pulse, and night sweats.

*Physical signs on admission.* Over right upper lobe, increased vocal fremitus and vocal resonance, dullness, moist râles, increased respiratory murmur with prolonged expiration, cough paroxysmal, sputum foul-smelling with free clotted blood. No tubercle bacilli. Other parts of chest normal. Temperature hectic from normal to 104.4° for three days, with sputum scanty; then he expectorated a large volume (fully two cups) very suddenly. Temperature normal next day. Transferred for operation. X-ray plate made lying down showed no definite evidence of abscess. The appearance was like that of acute localized tuberculosis. On standing the patient up a horizontal line was seen in the upper right lobe with a light area above and a dense area below the horizontal line. This line remained horizontal when the patient lay on his affected side. Stereoscopic plates were made, and the presence of an abscess half filled with fluid, and filled with gas above the fluid, was diagnosed. The depth of the abscess was shown, but not very clearly, by the stereoscope.

*Operation.* An incision was made in the axilla, ribs removed to allow free access, lung exposed. A large trochar was thrust into the lung, but failed to strike pus. This search was repeated four times, and on each occasion the surgeon (Dr. Garrow) smelt the trochar after the puncture. After the fifth puncture no pus was got, but the trochar had a fœtid smell. A large opening was made along the line of the last puncture, and the abscess was found and drained. Patient made an uneventful re-

Fig. 1. Abscess in lung, patient standing erect.

covery. I saw him four and one-half months after the operation; he was in excellent health, and had no cough. Screen examination presented the appearance of a normal chest.

CASE 2. A. N., age 52, admitted under Dr. Hamilton, Royal Victoria Hospital, Montreal, February 10, 1914, suffering from cough and profuse foul-smelling expectoration. Had pneumonia with empyema at 37. Appendicular abscess opened three months ago. For the last fifteen years he had had cough and expectoration, both worse during the last three months. For the last ten years he had been looked on as a case of tuberculosis of the lungs. Foul odor appeared in sputum two weeks ago, and has continued. Sputum now 16 ounces per 24 hours.

*Examination of chest.* Vocal fremitus in left infra-clavicular region; faint, and absent in the other areas. Percussion, posteriorly left side dull. Auscultation: Decreased murmur in left infra-clavicular region with loud râles both moist and dry. Other areas of chest silent. Skiagraphs showed level of fluid in abscess. The level kept horizontal as the patient moved from erect to lying on side (see radiographs). Fourteen days later, operation failed to localize the abscess, although an aspirating needle was inserted into the lung in various directions, but not smelled by the surgeon. On February 26th, three days later, foul-smelling pus escaped by the incision. The temperature fell to normal and the patient continued to improve. He gained seven and one-half pounds in about a month. He went home and the discharge lessened, and the expectoration increased. The former remained foul-smelling, but not the latter. On March 28th, X-rays showed abscess to be empty. On May 5th he had gained 32 pounds, coughed only on rising, spat once or twice a day. Wound not yet quite healed.

## CONCLUSIONS

From experience in these cases one gains the following information:

1. Abscess in the lung partly filled with pus and partly with gas can be diagnosed by X-rays.
2. A negative made with the patient lying prone is of no value.
3. A negative made with the patient erect will not show the condition unless the horizontal ray from the X-ray tube has passed through the horizontal upper border of the fluid.
4. It is essential to make a fluoroscopic screen examination with the patient erect, and to move the X-ray tube from the level of the upper part of the chest to the lowest part of the chest looking for the horizontal line. It may even be neces-

Fig. 2. Abscess in lung, patient inclined at 45° to perpendicular.

Fig. 3. Abscess in lung, patient lying horizontal with the abscess side downward. The surgeon failed to find this abscess and it burst through his incision three days after the operation.

sary to turn the patient from side to side to get the horizontal line shown exactly.

5. Having found the horizontal line the patient should be placed on the affected side, the hips being raised a little so as to get the spine horizontal, an anteroposterior screen examination should be made, and one finds that the horizontal line of the fluid in the abscess is now parallel with the spine. The upper and lower levels of the abscess are thus defined.

6. Stereoscopic views of an abscess do not appear very stereoscopic, as neither the horizontal line nor the congested tissues round the abscess lend themselves to stereoscopic work. An attempt should be made to localize the gas above the abscess. A practical method is to place lead buttons in front of and behind the chest, so that they are in line with the gas in the abscess. Then change the position of the tube and repeat the proceeding. Join by imaginary lines the positions of the first two lead buttons and of the second two. Where these imaginary lines meet lies the gas, and one gets sufficient idea of the depth to help the surgeon in his operation.

7. The surgeon should smell the trochar after each exploratory puncture.

# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN SURGERY

By M. G. SEELIG, M. D., Saint Louis, Missouri

THE surgeon Billroth once wrote to his friend, Professor Luebke, a letter that was a soul cry of futile protest, describing the wearing, dragging details in the daily life of an active surgeon, and interpolating every now and then the phrase, "*denn warum.*" One of the annoyances complained of by Billroth was the necessity of wading through a mass of medical literature,—a necessity which he met bravely, but nevertheless in the manifest spirit of "*denn warum.*" Nor is Billroth the only one to propose the hopeless "why then?" Even the book reviewer, who should have before his mind's eye, constantly, the determination to read into books a large part of every author's pride and hope and enthusiasm, even such a critic sighs wearily *denn warum.* Surely it is true that if scientific books were written only in answer to a specific need for them, there would be many less books published, and consequently a much larger proportion of worthy product. The temptations of authorship are great, but by just as certain a token the task of accomplishment is greater.

Let us, for example, in a spirit of honest inquiry, note just how much the books of the month furnish evidence, in some form or other, justifying their birth. And let us start off with Ashhurst's volume on the Principles and Practice of Surgery.[1] Only a few months ago, in commenting on the new work by Bryan, on Principles of Surgery, we pointed out the superfluity of such volumes. There are so many books on Principles that a new one must justify itself on some special ground, such as a more logical development of data, a particularly clear, incisive, didactic style, or a strong personal note based on extensive and well utilized experience. It is difficult to trace any one of these characteristics in Ashhurst's book. The arrangement of the chapters is just about as we always expect to find them:— Inflammation, Tumors, Surgical Technique, Injuries, Amputations, etc. There are in all twenty-nine chapters, divided into three groups, respectively devoted to General Surgery, Systemic Surgery, and Regional Surgery. It is open to question whether such a classification as this will not confuse the average medical student, but even so it certainly is almost impossible to do justice to such a classification in a volume even of a thousand pages; particularly difficult when almost three hundred of the thousand pages are devoted to bone and joint diseases.

As regards the detailed material contained in the volume one must say candidly that it is up to formal standard. There are very few if any serious omissions as far as subject heads themselves are concerned, but the broad scope of the work renders it painfully necessary to abridge to the limit. The important subject of fat embolism, for example, is dismissed in five lines, with the more or less misleading statement that the symptoms are the same as those of ordinary pulmonary embolism. Under the head of differential diagnosis between shock and hæmorrhage, the laconic statement is made that this differentiation "is frequently impossible"—and there the matter is dropped. Under transfusion, the author outlines the rather complicated method of Crile, and mentions none of the other direct or indirect methods; and this in spite of the fact that Crile himself now uses the Elsberg canula in many cases. Under the head of peritonitis, not a word is said by way of correlating the important subject of physiology of the peritoneum with the pathology of peritonitis. Under the subject of hernia, one notes with disappointment that Astley Cooper Ashhurst does not explain why direct inguinal herniæ are usually bubonoceles. It was Astley Cooper who furnished the first satisfactory explanation that I have been able to find in surgical literature. The question of cerebral compression is far from being settled; yet for the purposes of clear exposition Ashhurst would probably have done better to restate the very simple and satisfactory theory of Kocher, which is now so generally accepted. Anyone who has attempted to teach tumor pathology to students will question the wisdom on Ashhurst's part of adopting Adami's classification; it is difficult to see why the older and simpler even if less academic, description of tumors was not followed. And finally, may we not take rather vigorous exception to Chapter II, headed "Diseases Resulting from Inflammation?" This chapter discusses abscess, ulcer, sinus, fistula, gangrene, cellulitis, erysipelas, septicæmia, sapræmia and pyæmia. The inference, from the heading of the chapter, is that these conditions are diseases that arise from inflammation, and that other diseases must necessarily have some other than inflammatory origin.

All these are merely points open to question.

[1] Surgery; Its Principles and Practice. For Students and Practitioners. By Astley Paston Cooper Ashhurst, A. B., M. D. Philadelphia and New York: Lea & Febiger, 1914.

The work is preponderatingly good. We do not feel, however, that the book has fairly justified itself. Ashhurst has striven too laboriously to teach the student "to know." He says in his preface that at best all a textbook can do is to teach the student to know. His task would have been possibly more difficult, but certainly more satisfactory, had he not failed to realize that the best a textbook can do is to teach the student *to think*. If our educators could only see the hopelessness of teaching to know as contrasted with the fruitfulness of teaching to think!

Dr. Ashhurst, himself a fair and astutely keen critic, will be the last to see any hostile destructive criticism in our final "*denn warum?*"

THE discriminating reader has learned to anticipate two characteristics in almost every System of Surgery; and these are fullness of content and inequality of caliber. Fullness of content, by reason of the very fact that the work is a *System*, and therefore bulky; and inequality of caliber, because the different contributors possess varying degrees of capacity for executing their respective parts of the work. The essential value of any system of surgery, then, is in large measure proportionate to its completeness or fullness and to a fairly well sustained high level of excellence in all its parts. We have many excellent systems of surgery at our command; we have them in practically all languages; indeed, of late, thanks to a developing cosmopolitanism in medicine, we even have systems written jointly by American, English, and Continental surgeons. The purchase of such volumes necessitates, as a rule, the outlay of a not inconsiderable amount of money; and, once purchased, they call for a not inconsiderable amount of effort and time in order to extract the substance from them. It is of course difficult, almost to the point of impossibility, to standardize the value of books; but since this critique is tentatively aimed at answering the "*denn warum?*", we are obliged to set some arbitrary standard of value.

The standard that we shall adopt for this third volume of Choyce and Beattie's Systems of Surgery[1] shall be a double one; namely, the completeness of the work, and the balance of excellence characterizing the product of the various contributors. In all, there are eighteen chapters, devoted to the cardiovascular and lymphatic systems, the neck, nose, accessory sinuses, ear, pharynx, naso-pharynx and larynx, lungs, pleura, nerves, head, spine, jaw, skin, muscles, fasciæ, tendons, bursæ, bones, joints, and orthopedic surgery.

The opening chapter on the cardiovascular system, by E. Rock Carlin, is very little above the standard of a good quiz compound. Injuries of the heart and their treatment is disposed of in two pages, likewise diseases of arteries; there is no mention of the various phases of gangrene due to vascular disease, no mention of transfusion, practically nothing on thrombosis, embolism, and infarction, nothing on blood-vessel suture, just a perfunctory setting down of a small mass of trite data. The chapter on the lymphatic system by Dobson is fuller, but withal colorless, discussing simple and tuberculous lymphadenitis, lymphœdema, lymphatism, Hodgkin's disease, lymphosarcoma, and the lymphatic distribution of cancer in a formal and inadequate fashion. The chapter on the neck by Edmunds is inexplicably incomplete. It would be difficult to find a less adequate description of Grave's disease anywhere other than in a small textbook. The chapter on lung and pleura by H. M. Davies starts off most auspiciously with an excellent anatomical description of the pleura and lungs, followed by a discussion of radiology as applied to chest diseases, which in turn is followed by a resumé of the hypo- and hyper-atmospheric methods used in operations upon the chest and its contents; but when the author gets into the actual diseases of the chest, he falls from grace and turns out a very ordinary product.

Immediately following the chapter on the lungs by Davies, there is one chapter on Nerves by Sherren and two on the head and spine by Trotter, and in these three chapters we see for the first time what this System of Surgery might have been. Sherren furnishes a wealth of detail, an accuracy of statement, and a note of personal experience that is very little short of invaluable. The information is condensed, yet adequate and complete. Nowhere else, for example, can one read a more satisfactory and complete resumé of brachial plexus injuries, and nowhere else can one find, in short compass, a more satisfactory discussion of injuries to special nerves. The same high type of excellence characterizes the work of Trotter on the brain and spine. Well classified, thoroughly digested, and admirably presented, Trotter's chapters force the reader to the mental reservation that here he has found a valuable source of information. In Keen's System of Surgery, Cushing describes the physiology of cerebral compression better than it has been described before. In dealing with this same subject, Trotter out-Cushings Cushing. The pages devoted to spinal fracture should be read by every surgeon, and several pins should be stuck into the paragraph headed Time to Operate. Trotter, in contradistinction to practically all writers on this subject, cautions against haste in operating upon these spinal injury cases. This note of warning contains more than a kernel of truth — it is the whole nut.

After Trotter, there is nothing in the volume that is much different or any better than the material that is commonly current. There is rather a tone of inadequacy, nothing compelling, so that if, in the end, we again ask ourselves, "*denn warum*", we answer that we really cannot say why, that we scarcely feel an inner impulse to justify this volume of the System, but that, after all, we feel happy in the possession of the work done by Sherren and Trotter.

[1] A System of Surgery. Edited by C. C. Choyce, M. D., F. R. C. S., and J. Martin Beattie, M. D., C. M. Vol. III. New York: Funk & Wagnalls Company.